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CIVIL ENGINEERING

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Tri-Level Grade Separation on Access Expressway System for Willow Run Bomber Plant (See Article, Page 1)

Volume 14 ~ Number 1 ~

JANUARY 1944

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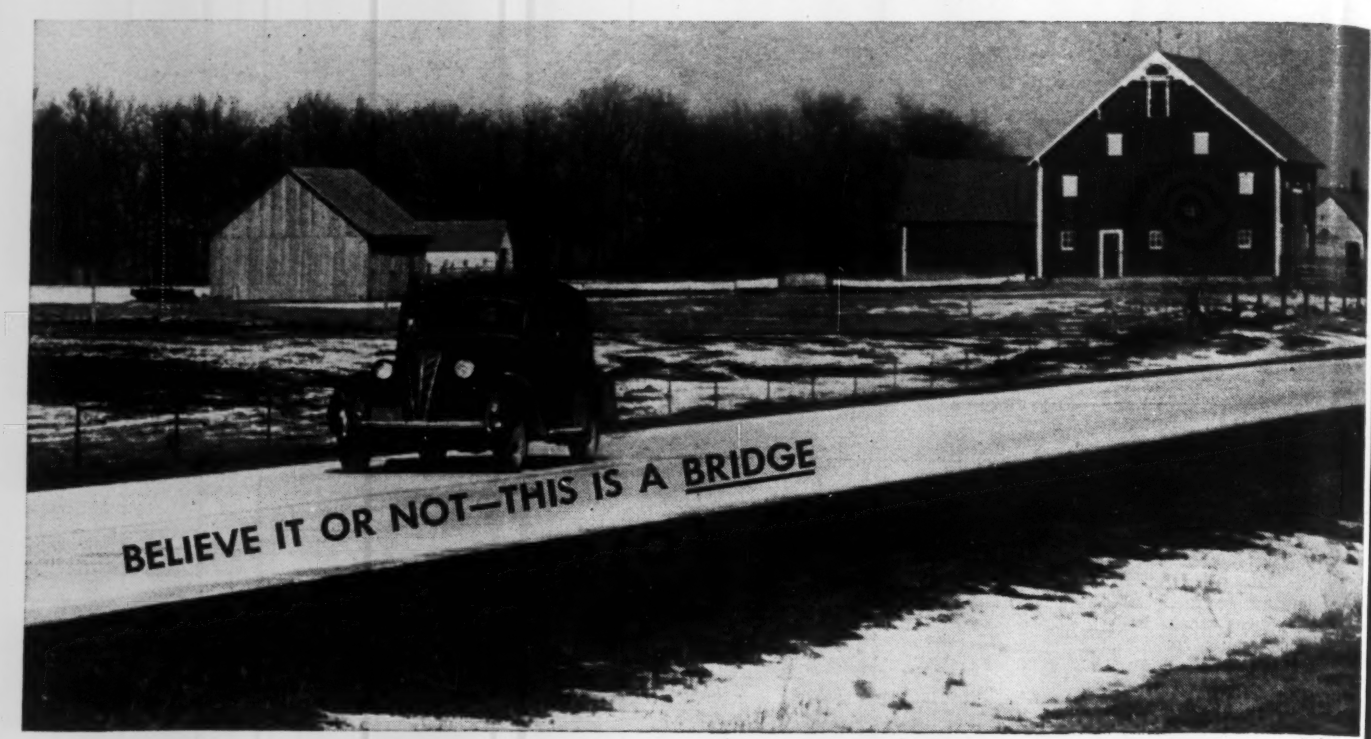

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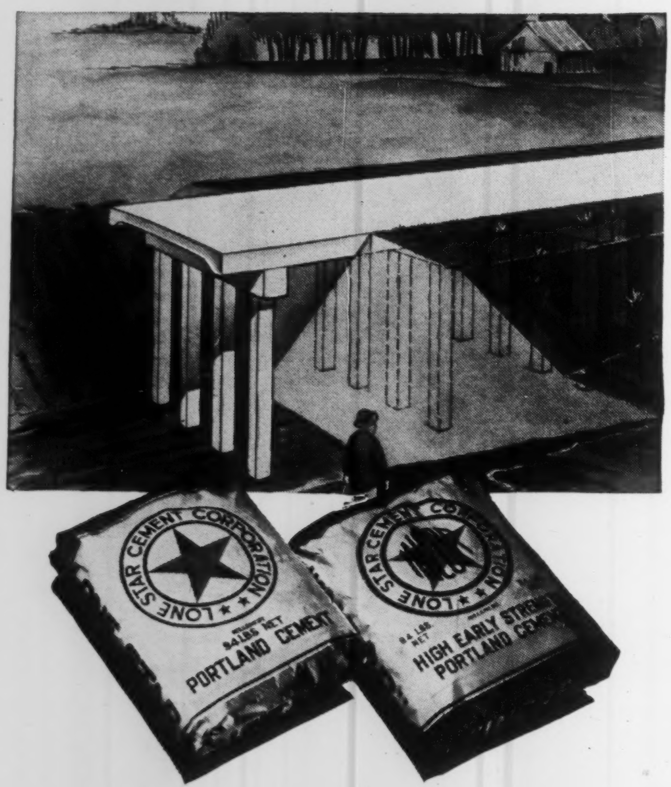
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VOLUME 14
JANUARY 1944
NUMBER 1

Expressways to Serve Willow Run Bomber Plant

No-Stop Access Routes Provided for Plant near Detroit, Mich.

By HARRY C. COONS, M. AM. SOC. C.E.
DEPUTY COMMISSIONER–CHIEF ENGINEER, MICHIGAN STATE HIGHWAY DEPARTMENT, LANSING, MICH.

EARLY in 1941 the Ford Motor Company's announcement of the building of a huge new plant for the mass production of four-motored bombers confronted the Michigan State Highway Department with one of the most critical industrial transportation problems of the present war. In this article, Mr. Coons gives a brief account of the nature of the problem, the types of highway design adopted for its solution, and the methods used to expedite construction and to secure successful operation of the completed facilities.

THE U.S. Bomber Plant at Willow Run, to give the plant its official name, was planned to be one of the major sources of the nation's growing air power. Its projected peak production would require, according to military and company officials, more than 50,000 workers. The site selected was near the small college town of Ypsilanti, Mich., in a strictly rural area without resident labor supply and with no accommodations for the housing of migrant workers.

Willow Run is 25 miles from the downtown section of Detroit, the nearest reservoir from which its labor requirements could be drawn. Railroad facilities were not then, and are not now, able to supply a commuting service between the city and the plant. Although Detroit industrial employees are accustomed to driving long distances to their jobs, existing trunk-line connections were not adequate in routing or capacity to carry the estimated worker traffic.

The then-existing trunkline highways between Detroit and Ypsilanti were working at near capacity, with maximum hourly volumes of about 2,500 vehicles. On the basis of projected ultimate employment, it was estimated that some 30,000 workers would move in and out of the plant at the heaviest shift changes and that these would produce a peak hourly traffic load on the trunk lines involved of more than 8,000 cars and 140 buses in addition to the normal traffic load. Furthermore, most of the secondary roads in the immediate plant area were entirely unsuited for carrying the traffic generated by plant construction. It was certain that they would fail completely under full production traffic.

Realizing that the situation demanded prompt attention, the State Highway Department secured the cooperation of the War Department, the Ford Motor Company, and the Wayne and Washtenaw County Road commissions. Conferences with representatives of these agencies during the spring and summer of 1941 resulted in the adoption of comprehensive plans for the Willow Run Access Expressway System.

The problem of providing adequate roadways to Willow Run arose at a time when the State Highway Department was engaged in planning the Detroit Industrial Expressway. This project—part of the Department's program for metropolitan transportation improvement—envisaged the construction of a limited-access motorway crossing Detroit from east to west with an extension to the southwest to connect with future inter-regional highways to Toledo and Chicago. The projected route of the extension ran from the Detroit city limits to within a short distance of the bomber plant property. This part of the plan was at once utilized to meet the emergency.

As finally developed and built, the Willow Run Access Expressway System (Figs. 1 and 2) consists of four parts:

1. The Willow Run Expressways—the roadways and structures around the plant designed to absorb and transfer the surges of traffic between the plant gates and the principal highways of the area.
2. The southwesterly extension of the Detroit Industrial Expressway modified to provide direct and adequate highway connection between the Willow Run Ex-

TRI-LEVEL CROSSING ON WILLOW RUN EXPRESSWAY TRAFFIC INTERCHANGE

pressways and the street system of the City of Detroit.

3. The Ypsilanti South Belt Line, added to afford unimpeded access to the Willow Run Expressways from points on state trunk lines west and southwest of Ypsilanti.

4. The access highway to the Willow Run town site, a housing project laid out to accommodate some 25,000 persons.

In keeping with their function, the Willow Run Expressways practically border three sides of the very extensive plant property, which includes a large airport as well as the giant fabricating and assembly plant. In addition, short branch roads connect this distribution belt with the plant gates and with the nearby trunk-line arteries. There is a total of 16 miles of road in this part of the system.

Seven structures separating the grades at highway intersections and three at railroad crossings are required to assure the safe and unimpeded flow of traffic in the plant area. The two grade separations at the main plant gates have roadways at three levels.

The section of the Detroit Industrial Expressway built as a part of the Willow Run access system is 17 miles long and extends from four miles east of the southeast corner of the plant property to the Detroit city limits at Wyoming Avenue near U.S. 112. Traversing the highly congested area centering around the Ford industries in Dearborn, this expressway is necessarily designed for limited access. In addition to 4 highway bridges over streams, 32 highway grade separations and 8 railroad separation structures are required in this heavily industrialized suburban district.

Limited access was also provided for the Ypsilanti South Belt Line to protect its plant-access and trunk-line traffic from local and roadside interference. It is 6 miles long and includes a stream crossing and two separation structures at intersecting highways. The Willow Run Town Site access highway consists of $3^1/_2$ miles of 22-ft concrete pavement with two road and one railroad grade separation. After it leaves the vicinity of the plant, it carries local traffic entirely. Thus the complete access system comprises 42.5 miles of highway, 5 bridges, and 55 grade separations.

EXPRESSWAYS DESIGNED FOR UNUSUAL SPEEDS

These Willow Run access expressways were planned to expedite the movement of the brief peak volumes of traffic which it is their function to accommodate. The highway was designed for maximum capacities at driving speeds in excess of any previously considered by highway engineers. (At the present time the roadways in the vicinity of the plant itself are developing capacities in excess of 1,100 cars per lane per hour). Practically every detail of the design was adopted to promote safety and to protect the traffic-carrying capacity.

In width, the right of way varies from a minimum of 300 ft to 414 ft, with additional width at intersections with transfer facilities. The necessary land was obtained under a limited-access highway law passed for the purpose of making possible the development of these expressways. The right-of-way widths used, especially in the more built-up areas, are sufficient to permit the construction of service roads should they become necessary. In fact a limited length of service road was built as a part of the project in order to relieve local conditions. Adjacent to the Willow Run plant, a portion of the proposed service-road system was developed by offsetting the new route and using the existing road for service.

As the expressways are constructed on grades an average of 3 ft above the natural level of the ground, side ditches are unnecessary except in a few locations. This high grade was required by the extremely high water table in this whole section. On certain portions of the expressway system in the plant area, where access to roadways is not limited, the raised roadway prevents intrusion except at a few established intersections.

Gradients on the expressways are limited to a maximum of 2.5% on straightaways and 3.5% on ramps. Express roadways pass through separation structures on a straight grade. Except in two locations, a maximum curvature of 1°30′ was maintained. Broad 12-ft shoulders are carried full width over all bridge structures to guard against constriction of the traveled way.

In the vicinity of the plant, 11-ft lane widths were used with 12-ft lanes on the southwesterly extension of the Detroit Industrial Expressway. In general, there are two lanes in each direction throughout the system. At interchanges as many as five lanes in each direction are provided where necessary.

STEEL ELIMINATED FROM PAVEMENT

Because of the need of conserving critical materials, steel reinforcement was eliminated in all pavement slabs and curbs. To accomplish this, a 9-in. uniform section was adopted instead of the usual thickened-edge slab. Load-transfer devices were also eliminated at all expansion and contraction joints. Keyway joints were used in place of tie bars to hold adjoining slabs even at longitudinal center joints, and to connect roadway

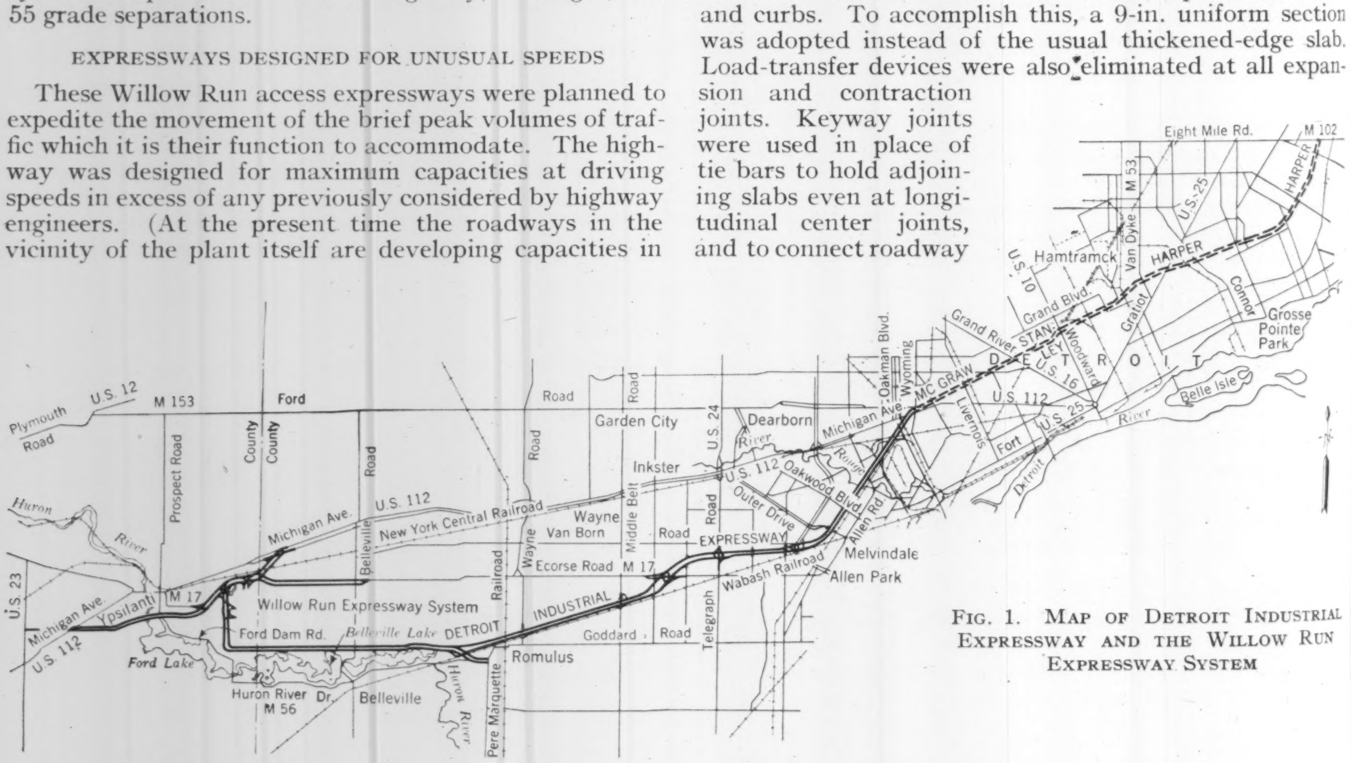

Eight Mile Rd.
M 102
HARPER
M 53
U.S.-25
Van Dyke
Hamtramck
HARPER
U.S. 10
Grand Blvd.
Gratiot
Connor
Grosse Pointe Park
Grand River
STANLEY
Woodward
Oakman Blvd.
Wyoming
MC GRAW
D E T R O I T
U.S. 16
Belle Isle
U.S. 112
U.S. 25
River
Detroit
Fort
Livernois
Michigan Ave.
Dearborn
River
Rouge
U.S. 24
Inkster
U.S. 112
Oakwood Blvd.
Outer Drive
Allen Rd.
Road
EXPRESSWAY
Melvindale
Wabash Railroad
Allen Park
Telegraph
Road
Plymouth Road
U.S. 12
M 153
Ford
Road
Road
Garden City
Prospect Road
County
County
Road
Road
Huron River
U.S. 112
Michigan Ave.
New York Central Railroad
Wayne
Van Born
Middle Belt
Road
Belleville
Wayne
Ecorse Road
M 17
U.S. 23
Michigan Ave.
Ypsilanti
M 17
Willow Run Expressway System
Railroad
INDUSTRIAL
U.S. 112
Ford Dam Rd.
Belleville Lake
DETROIT
Goddard
Road
Ford Lake
Romulus
Huron River Dr.
M 56
Belleville
Huron River
Pere Marquette

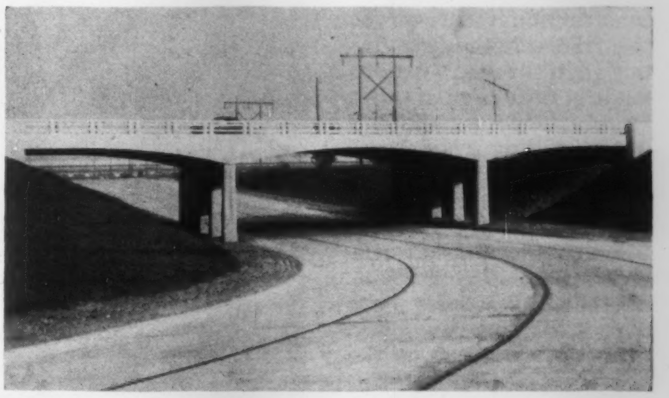
FIG. 1. MAP OF DETROIT INDUSTRIAL EXPRESSWAY AND THE WILLOW RUN EXPRESSWAY SYSTEM

slabs with curbs. As a result of this procedure, approximately 36 tons of steel were saved for each mile of two-lane pavement.

The typical cross section for the expressway was carefully designed with wide shoulders and flat slopes. Although the sections used are influenced by the high design speed and by appearance factors, the prime reason for this was to facilitate maintenance and provide ample snow storage. The shoulders were stabilized for all-weather use, and top soil was salvaged along the entire route and used on the slopes to prevent erosion and promote a rapid growth of grass. Vertical curves were used at the shoulder line and at slope stake points to smooth out the section.

A major factor affecting the design of the Willow Run expressways was the adoption of the principle of directional interchange. This was done in the belief that speed gained by careful planning on the straightaways should not be offset by delays at turns. Studies of the estimated traffic and of its sharply peaked occurrence indicated that free flow would be impeded by the turning maneuvers required on the conventional cloverleaf types of rotary intersections. Except where special local conditions forbid, therefore, the roadways at transfer points are arranged to permit normal turning maneuvers. This means that the driver turns to the right or left in the actual direction of his route. This is in contradistinction to the cloverleaf, on which the driver must turn to the right regardless of the desired direction of travel. In order to accomplish this, the dividing strip at important intersections was widened to as much as 1,000 ft. This allowed a curvature for the interchange roadways sufficient to permit a turning speed on ramps of from 35 to 40 miles an hour.

As another means of expediting the expressway traffic, vehicles are not halted before they enter a main roadway at any intersection. This kind of operation is obtained by careful design of transfer roads. All such roads take off from deceleration lanes and merge with the expressway pavement through acceleration lanes. Where transfer roads are closely spaced, these auxiliary lanes become a continuous added lane.



Grade Separations Avoid All Interruptions to Flow of High-Speed Traffic

To meet conditions such as are found at the gates of the Willow Run and River Rouge plants, where extremely large volumes enter the expressway, several additional lanes are provided. These form a merging area wide enough and long enough to permit the safe and orderly organization of the expanded traffic stream.

NO STOP SIGNS—NO TRAFFIC LIGHTS

There is not a single stop sign or traffic light on the entire system.

In addition to the expressways themselves, certain roads in the vicinity of the plant were improved. East of the plant and airport, a portion of trunk line No. 56, known as Belleville Road, was widened and resurfaced to provide 4 lanes. What is known as Beck Road, to the east of the airport, was improved to provide access to the Willow Run air base with a two-lane concrete pavement. Another problem involved furnishing access to the Willow Run housing area, and this was accomplished mainly through an interchange placed between the plant and Ypsilanti. This interchange was connected to the actual housing area by a two-lane concrete pavement about 3.5 miles long. In addition, a connection is being constructed between this road and Michigan Avenue, to furnish an outlet for the housing area to the east. Spurs were added from these latter two roads, each about a half mile long, in order to accommodate the housing area as efficiently as possible. These additional facilities utilized existing rights of way almost entirely and therefore represent a lowering of design standards.

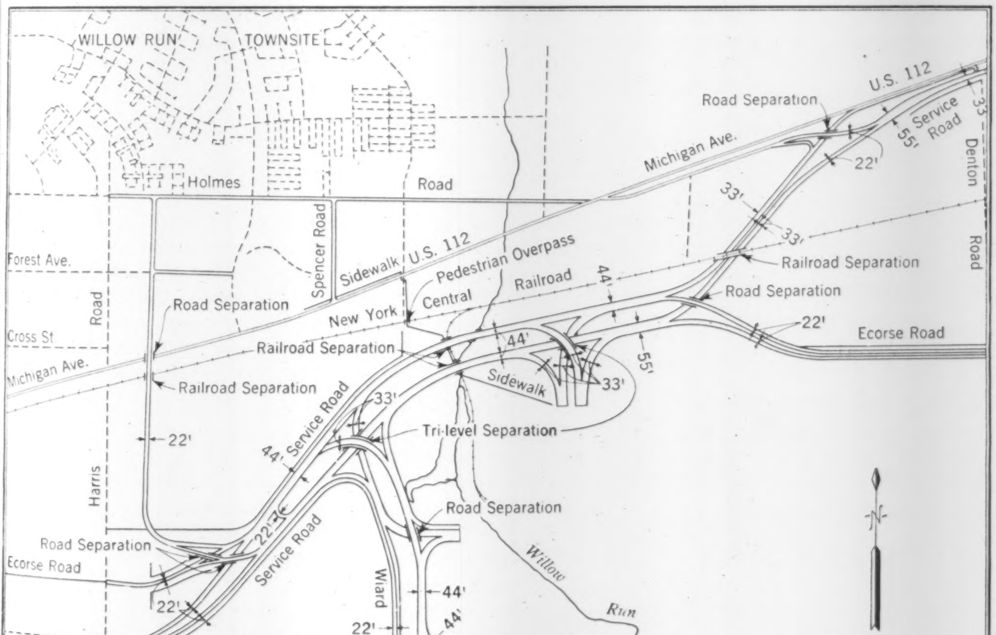


Fig. 2. Western Terminal Facilities of the Willow Run Expressway System

All the bridges and separation structures on the Willow Run access expressway system were designed in conformity with the specifications for H-20 bridge loading. Of special interest are the design and

ALL CROSSINGS OF LOCAL SERVICE ROADS ARE SEPARATED

construction features of the two tri-level grade separations and the modifications made in the design of other structures to meet the conditions arising from shortages of critical materials. Selection of the tri-level type of structure was dictated by the unusual concentration and complexity of the traffic movement anticipated at the two principal gates of the bomber plant. Each tri-level, as it is used in the scheme of traffic accommodation, takes the place of two normal structures, and in addition simplifies the resulting traffic pattern. The fact that three levels of traffic cross the structure at a common intersection, with the upper and lower levels curving in opposite directions and having their roadways superelevated, presented difficult problems for both the design and the construction engineers.

The substructures for the tri-level structures consist of reinforced concrete column and girder piers and gravity type "stub" abutments. The end columns of the piers supporting the middle roadway also form a part of the piers supporting the upper roadway. The foundation material is sand and clay and the substructures were designed for a maximum foundation pressure of 3,600, and an average pressure of 2,500 lb per sq ft. The abutment footings for the high-level decks were placed in the approach fills and supported on piles. The superstructures are of the deck type and consist of reinforced concrete slabs supported by steel I-beams and girders. The roadway widths on the structures provide for the same facilities, shoulder to shoulder, as the approach grades.

Construction of the tri-levels started before the situation regarding materials became critical and therefore proceeded with only slight alterations in the original plans. These alterations consisted of an increase in the depth of the intermediate pier footing to make possible a decrease in reinforcing steel, and the substitution of concrete handrails for the metal ones originally specified.

SAVING STEEL ON HIGHWAY STRUCTURES

Continuous concrete T-beam-type superstructures were designed for other highway structures included in the expressway project, to eliminate as far as possible the use of critical materials. Structural members were designed somewhat deeper than was consistent with normal working stresses in order to reduce the amount of reinforcing material. Also, increased allowable unit stresses were used. The concrete beams were designed with curved bottoms and this resulted in more economical distribution of concrete, a saving of reinforcing steel, and a more pleasing appearance. It is estimated that designing for continuity at supports accomplished a 10% saving in the cost of superstructures. To date, modification of design and substitution of materials have saved a total of 4,900 tons of steel.

Two tracks of the Michigan Central Railroad cross the expressway near the Willow Run bomber plant. It was originally planned to carry the railroad over the expressway, at this site, on a four-span steel-girder bridge with a reinforced concrete deck and reinforced concrete substructure. Because of the shortage of structural steel, this structure was redesigned. Steel girders were used for the center spans but the concrete slab was eliminated, materially reducing the dead load, and timber trestles were substituted for the end spans. Redesigning this structure resulted in a saving of approximately 473 tons of steel.

Construction was started on the Willow Run highway system in the fall of 1941, Defense Public Works funds being used to finance the initial construction. After the passage of the Defense Highway Act of 1941, access funds so provided were used for the remaining construction. By the end of the 1941 construction season, 12 miles of two-lane highway had been built around three sides of the plant area, greatly aiding the movement of construction-worker traffic.

Early in 1942, the Willow Run Expressway and Section II of the Detroit Industrial Expressway were put under construction and were substantially completed by fall. In the spring of 1943, contracts covering the bulk of the projects on Section III of the Detroit Industrial Expressway and of the Ypsilanti South Belt were awarded. It is expected that the entire Willow Run expressway system will be in operation some time in the winter of 1943–1944 with the completion of current construction on Section III.

Completed portions of the Willow Run access expressway system provide roadways for the gathering and distribution of the workers at the bomber plant. Employment at that giant arsenal of the nation's air power is as yet far under the top figure estimated for its full production. It is believed that the entire expressway system will be opened to traffic before the plant's peak of production and employment is reached.

Section III is the gateway to the system from the Detroit area, and until it is functioning the system will not take on its full share of the traffic between the plant and the metropolis. Nevertheless, present use is on a scale which fully proves the necessity and utility of the system. The amount of this use in relation to plant employment exceeds anticipations, and should the number of plant workers reach that originally forecast, the expressways will be loaded to their full capacity.

Several developments have taken place in the plant area which are making significant modifications in the pattern of its traffic movement. The most important of these is the establishment north of the bomber plant of a worker dwelling project. Access to the plant from this area is necessarily across the route of the expressway. This movement has already required the provision of a pedestrian overpass with two miles of sidewalk and an additional plant access highway.

The directional interchange scheme of traffic accommodation is functioning successfully. With traffic coming out of a single plant gate at the rate of more than 3,700 vehicles an hour, congestion is entirely avoided, and distribution is organized quickly and without confusion. Transfers at intersections throughout the system are made with similar safety and efficiency.

Development of the Inter-American Highway

Rôle of Public Roads Administration in Cooperative Construction in Central America

By E. W. James, M. Am. Soc. C.E.

Chief, Inter-American Regional Office, Public Roads Administration, Washington, D.C.

CONSTRUCTION of the Inter-American Highway has recently been vigorously pushed as a military expedient. Its development, however, has taken many years. Preliminary conferences date back to 1923, and it was in 1930 that the first funds were appropriated by Congress for investigations and surveys. The huge project has been remarkable throughout for the cooperation that has been shown by the republics of Central America. Mr. James, who has been in charge of all Inter-American Highway work by the Public Roads Administration, presented the paper of which this is an abstract, before the Highway Division at the Los Angeles Convention of the Society.

JUST when or how the concepts of an Inter-American and a Pan-American Highway were first formed will probably never be determined. (The Inter-American Highway is that part of the Pan-American Highway which is located in Mexico and Central America.) Most great projects first shape themselves as dreams in the minds of men. Once told, these dreams become common property; and if by chance they strike the popular fancy because of their promise of adventure or profit they soon develop into popular opinion.

More or less obviously, the proposal to construct a continuous highway through the Republics of North and South America developed naturally and inevitably from the many projects and long discussions that for forty years prior to 1920 had been directed toward the construction of a railroad through these republics. Incidents surrounding the proposals and schemes for an intercontinental railway relate themselves very definitely to the later and current policy of direct cooperation with the Latin American countries in the construction of highways.

During a series of conferences—in 1923 at Santiago, Chile; in 1925 at Buenos Aires, Argentina; in 1928 at Habana, Cuba; and in 1929 in Rio de Janeiro, Brazil—the first official action appears to have been taken toward a system of international roads in Central and South America. The action was prompted by the United States delegation at the Santiago conference. Following the recommendation of these conferences, the Congress of the United States in 1929 authorized an appropriation of $50,000 for a reconnaissance survey and study of a feasible route between North and South America. To secure cooperation in this initial project, a conference was held in Panama in 1929 following the Congress in Rio de Janeiro, and the cooperation of the Central American republics was secured for prosecuting the reconnaissance work.

The first party to be sent out by the Public Roads Administration proceeded to Panama in June 1930, and in preparation for the extensive reconnaissance to follow, made a careful study of the geography, topography, and meteorology of the entire Central American isthmian region. It was, of course, impossible to undertake a thorough exploration of all possible routes in the isthmus, which ranges in width from 45 miles at Panama to 250 miles or more in Guatemala.

At the Panama conference in 1929 the general principle had been enunciated that as far as practicable the selected route should make use of existing fragments of highway in the several countries. Obviously such roads indicated to a certain extent the location of the denser population and the most insistent demands of traffic, but population alone was not a controlling element in these first studies.

The Caribbean coast of the entire isthmian region is lower and flatter than the Pacific coast. This condition would at first appear to indicate a desirable location for a highway, but the coast line of the Caribbean is extremely irregular and a large part of the population is concentrated in a relatively few coastal towns. To reach this population would require a road along the littoral or close to it, but the irregularity of the coast would add greatly to the total length of the route, and further extensive deviations would be necessary to avoid numerous swamp areas.

Any general straightening to avoid such difficulties would necessarily throw the line into the interior, thus missing much of the population on the Caribbean side. Moreover, since the central cordillera is much nearer the Pacific coast, the rivers on the Caribbean side are much longer and larger than those draining into the Pacific. To cross the former in their lower reaches would require heavy and expensive bridges. Generally throughout the region the rainfall on the Caribbean side is almost double that on the Pacific, which means greater im-

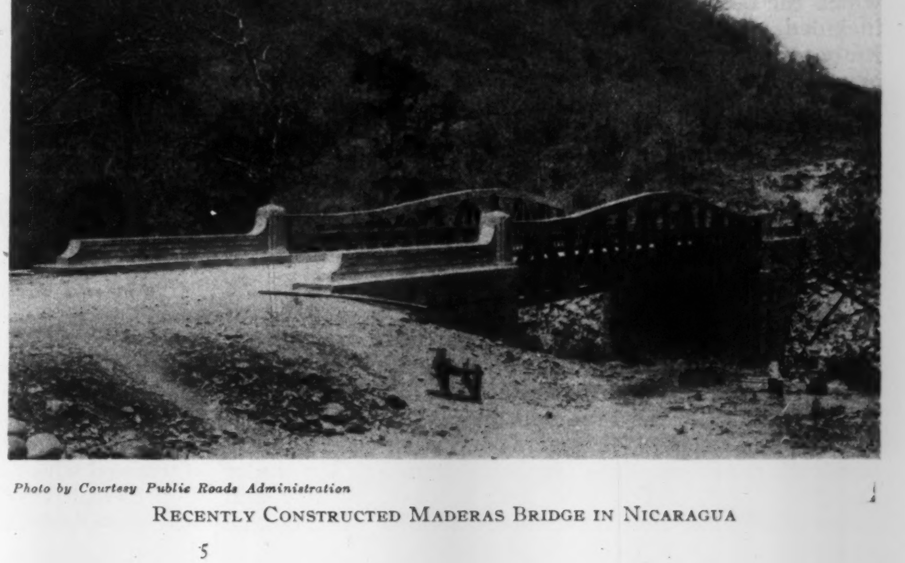


Photo by Courtesy Public Roads Administration

Recently Constructed Maderas Bridge in Nicaragua mediate difficulty in construction and greater permanent difficulty and expense in maintenance. In addition, El Salvador, which alone among the republics has a coast line only on the Pacific side, could not be unceremoniously passed by. Finally, most of the population throughout the entire region is strung along the highlands adjacent to the Pacific coast or on the tablelands immediately to the east. This distribution of population indicated the location of the better existing roads.

Photo by Courtesy Public Roads Administration

Through the Rugged Hills of Costa Rica Cuts This Crushed-Stone Section of the Inter-American Highway

A study of these data and numerous discussions regarding local geographic and topographic conditions with officials of the several countries led to but one conclusion as to the general route. It should lie along the Pacific or, wherever it became necessary to go into higher altitudes to get through or to reach centers of population, near the Pacific side of the continental divide. This general decision at once reduced the amount of exploratory field work enormously.

The reconnaissance survey continued until the fall of 1932, when the Panama office was closed and all the material brought to Washington, where the report was prepared. This document included a complete set of photographic mosaics made by aerophotography on which the reconnaissance line was laid. The report also included an approximate plat and profile of the entire route to uniform scale. The report was issued in February 1934 and complete copies, with all mosaics and plans, were furnished each of the countries concerned, with the request that they indicate their approval or disapproval of the proposed route.

Although activities connected with the Inter-American Highway have always been of an international character, it has been the part of the United States usually to assume leadership in securing concerted action or in encouraging, promoting, and even in financing specific activities. In June 1934 further funds were provided for additional surveys based on the reconnaissance already made, and the sum of $1,000,000 was set up for construction on such terms and under such conditions as should be satisfactory to the President of the United States.

Because relations with foreign countries were obviously involved, these appropriations were carried in law under the State Department title, and it was necessary and appropriate that that department should have charge of all preliminary understandings. It was equally clear, however, that certain technical details could not be satisfactorily discussed by diplomatic notes, and that the conduct of the surveys and supervision of construction should be handled by the technical representatives of the governments concerned.

It was agreed, therefore, that all preliminary approaches to the other governments should be made through the usual diplomatic channels, and that the technical representatives of the U.S. Public Roads Administration should then be introduced through our missions to the several countries. After these initial contacts were established, it was understood that the technical personnel would be free to make all the detailed arrangements for cooperation, interviewing local officials and extending the original contacts as far as required. This general arrangement worked well in all cases. At no time was there any friction in the field and we were especially successful in avoiding or removing misunderstandings.

With the appropriation of $1,000,000, it became necessary to devise a plan for cooperative effort. In June of 1942 the State Department and the Public Roads Administration drew up suggestions for such a general plan applicable in all the countries.

An effort was first to be made to secure the agreement of each country to proceed with construction on the final line with its own funds to the extent that such funds were, or might become, available. It was to be emphasized that public domain constituted an asset of the first importance in any plans for the local financing of construction, for establishing settlements in the regions which the highway would open up, and in furthering desirable immigration and colonization. Specifically, the several countries were to be urged to withdraw from entry all available public domain affected by the proposed route.

Each country was to be induced also to hold free from encumbrance all its unobligated financial and other resources. For instance, stone quarries and gravel deposits should be withdrawn from entry if within useful distance of the line. Timber concessions similarly located should not be granted. Gasoline taxes and motor vehicle revenues then unobligated should be kept free, and all concessions likely to exploit the road should, for the time being, be withheld.

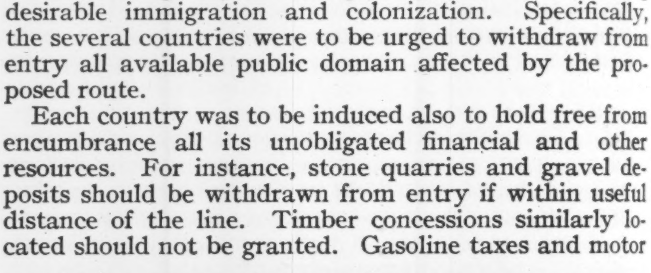


Photo by Courtesy Public Roads Administration

A Dumping Bull Cart Used on the Tipitapa-Maderas Section of the Highway in Nicaragua

Finally, it was suggested that a plan of financing be determined which could be presented to the Latin American representatives. This must be acceptable, of course, to the government of the United States. Accordingly in

Photos by Courtesy Public Roads Administration

An Old and a New Stone Masonry Arch Used on the Inter-American Highway

the summer of 1934 the State Department communicated with the several governments of Panama and Central America, calling their attention to the available appropriation, requesting their approval of the reconnaissance report as indicating an acceptable route, and asking them to give consideration to construction that might immediately be undertaken on a cooperative basis.

First results were secured much earlier than expected. By December favorable replies had been received from all the countries generally accepting the reconnaissance survey, the two exceptions being where nationally owned railroads were paralleled. When definite arrangements were completed, agreements had been secured for cooperation in the construction of 15 bridges and approximately 55 miles of highway. The terms of cooperation are especially interesting in view of the fact that there was no legal prescription in the act of Congress making the appropriation, other than that they should be satisfactory to the President of the United States.

In general the position was taken that the United States should not make any unqualified gift to any of the countries, but it was not considered wise under the cirstances to fix definitely any specific amount of participation by the other countries, and for this reason two decisions were reached which gave us considerable freedom of action and at the same time met the condition of requiring active cooperation by each of the countries. The funds available were not apportioned definitely to the several countries. It would have been possible to make such an apportionment on the basis of population, assessed valuation, area, annual budget, or some other suitable index, but it was recognized that this might deny some country funds for a desirable improvement and might impel other countries to more extensive programs than they could finance. Therefore it was decided to canvass the several countries concerned and select specific projects after a full discussion of the items advantageous and possible in each.

Further, in order to control as far as possible the adequate completion of the accepted projects, it was desired to confine them as far as possible to bridge construction at points where bridges were needed and would become immediately serviceable on completion. By securing agreements with the several countries to construct the substructures of such bridges with the understanding that the United States would then furnish and place the superstructures, we accomplished two very desirable results. Each country was free to pay its own bills and no transfer of funds would be necessary either from the United States to any of the other countries, or from any of the other countries to us. By confining our contribution to the details that would complete the structures, we assured ultimate completion.

This arrangement was possible because no definite apportionment of the whole fund was made among the countries and no definite percentage of participation by the other countries was required. This plan worked with complete success.

BRIDGES COMPLETED IN CENTRAL AMERICA

Surveys and plans were completed for all projects by engineers of the Public Roads Administration in a field office in Costa Rica, and these received formal approval of the cooperating countries. The first group of bridges undertaken consisted of three suspension structures—over the Chiriquí River in Panama (787 ft in overall length), the Choluteca in Honduras (1,088 ft from end to end of anchorages), and the Tamasulapa in Guatemala (486 ft long). Subsequently other structures were built over the Platanal, San Cristóbal, and Chirigagua in Panama; over the Amatal and Tahuapa in Guatemala; and over the Rio Grande, Estelí, and Maderas, Nicaragua.

The construction program included not only these bridges but also sections of highway in Nicaragua, Guatemala, and Costa Rica totaling about 55 miles. In addition 5 bridge sites were surveyed and bridges designed for erection at the expense of the several countries. Four bridge sites were investigated at the request of the countries concerned and engineering advice furnished regarding type of structure and method of building.

Also four road surveys were made in Panama, Nicaragua, Guatemala, and Costa Rica aggregating 117 miles for independent construction by those countries, and reconnaissance surveys were completed for the reconstruction of four difficult mountain sections on already existing roads.

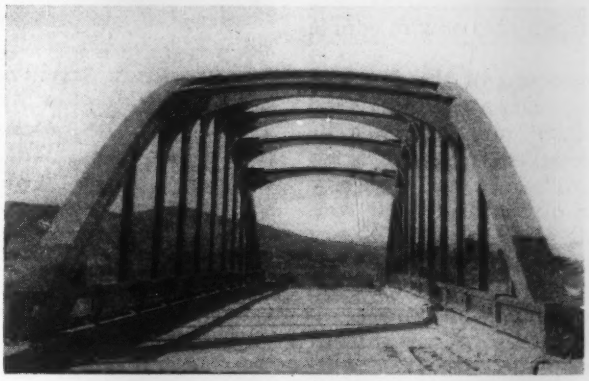


Photo by Courtesy Public Roads Administration

Rio Grande Bridge in Nicaragua

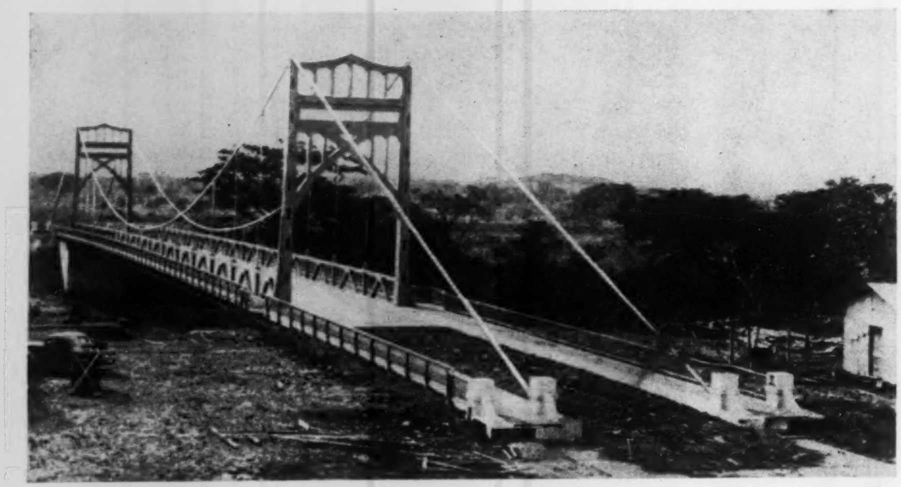


Photo by Courtesy Public Roads Administration

THE CHIRIQUÍ SUSPENSION BRIDGE IN PANAMA

Finally a group of standard plans was designed and made available to the several countries for use in future bridge construction. In all, 39 cooperative projects were carried out with the $1,000,000 appropriation. The expenditure on construction alone, omitting projects of a distinctly engineering and overhead character, resulted in expenditures by the other countries of $709,578 and by the United States of $679,535.

Obviously the general procedure adopted resulted in the disbursement of a considerable part of the United States' contribution either in the United States or to American-owned utilities. Altogether, 84.2% of the entire $1,000,000 was spent for United States materials, services, and personnel, and 9.4% was spent for foreign purchases, services, and personnel. The remainder of 6.4% was later used largely in beginning a very difficult piece of road construction in Costa Rica. This work was still in progress in 1941, when a new basis of cooperation was introduced, and additional funds were made available.

By that time the efforts of the Public Roads Administration in encouraging good road and bridge engineering along the lines of American practice had been so far successful, and the Good Neighbor Policy of the present administration had awakened such a gratifying response, that Congress on December 26, 1941, authorized an appropriation of $20,000,000. This is to be expended over a period of 5 years, to be matched by $10,000,000 from the cooperating countries for further construction on the line of the Inter-American Highway. Two appropriations have been made under this authority amounting to $12,000,000. Of this, slightly over $7,000,000 has already been definitely allotted to projects now in course of construction.

Before terminating this brief account of the development of cooperation in Central America as accomplished by the Public Roads Administration, reference must be made to the multitude of lesser details involved in carrying out such a construction program. It was necessary to arrange for the transportation of a considerable tonnage of steel and other materials and supplies. Every one of the countries concerned agreed to waive all port charges, wharfage and lighterage where these were involved, to provide either free transportation on government-owned railroads or the advantage of government rates on concession railroads. Frequently it was possible to arrange for postal and telegraph franks, and each country provided at its own expense all rights of way and easements involved, including those necessary for securing stone, sand, gravel, and timber.

Policies affecting personnel have been most carefully considered at all times and the Public Roads Administration has been successful in avoiding much potential friction by exercising great care in its organization plans to recognize local opinion. Political connections are scrupulously avoided. Personnel objectionable locally is passed by, however much it might be to our advantage to employ it. Nationals are not exchanged except when unavoidable, and when a Honduran is employed in Nicaragua or a Panamanian in Salvador a mild repercussion is likely to occur even after ten years of cooperation.

Generally the aim is to employ a single American as resident engineer in each country where cooperative work is being done, to have charge of all operations. As far as possible, all other personnel is recruited from the cooperating country. Additional personnel from the Public Roads Administration is supplied only when requested for some particular purpose. The basis of this policy is to develop local talent as far as practicable, to employ local engineers, train them in American methods and practice, give local labor the lion's share in construction forces, and teach them to use American equipment.

Then came Pearl Harbor and the war. Today provision has been made for closing most of the gaps between the Mexico-Guatemala boundary and the Canal Zone. The highway is being built faster than the finances of any of the countries will permit, and for military purposes additional expenditures not previously contemplated have been made. However no one can doubt the wisdom of this in view of the string of airports requiring service along or adjacent to the highway. The disposition on the part of these countries to cooperate later in completing a commercial highway will not be lessened in any way. The principle of cooperation has been established. The contribution of the United States can be adjusted to conform with computable or potential returns, and it certainly appears at this time that the paths of wisdom will lead to closer, more effective, and more productive cooperation in the years to come.

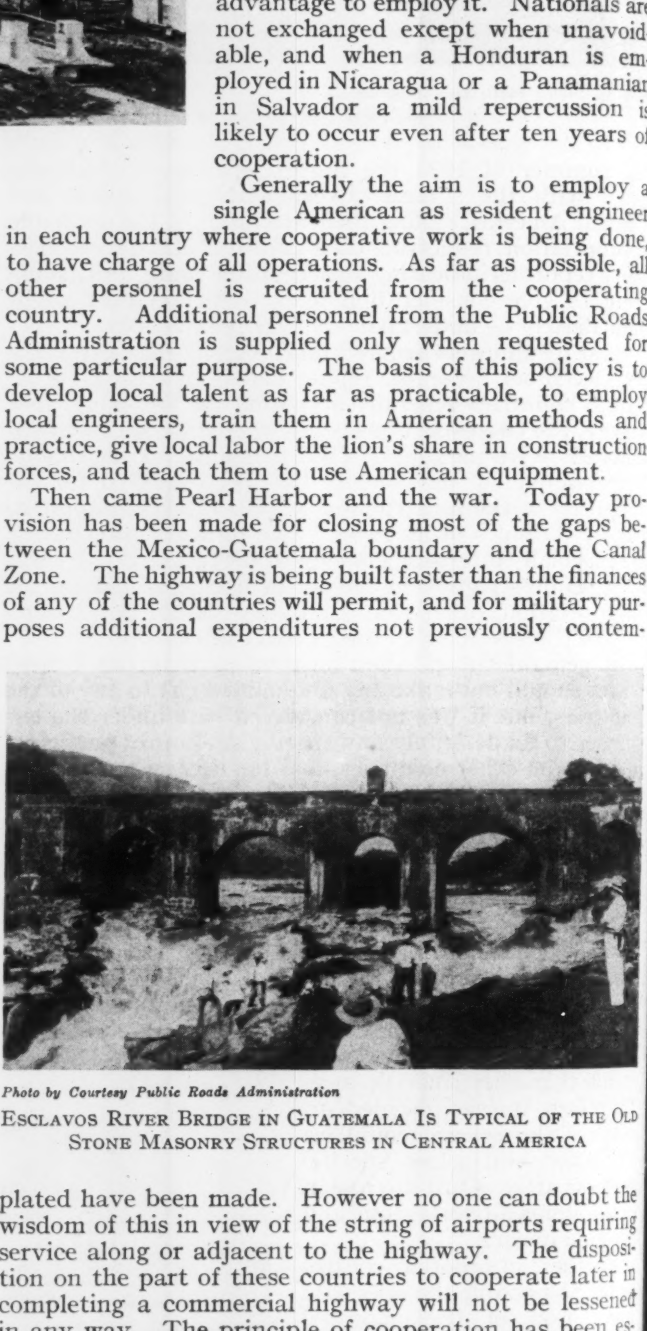


Photo by Courtesy Public Roads Administration

ESCLAVOS RIVER BRIDGE IN GUATEMALA IS TYPICAL OF THE OLD STONE MASONRY STRUCTURES IN CENTRAL AMERICA

Welding to Ensure Composite Beam Action

Economical Girders of Structural Steel and Concrete Slabs Used on Two California Highway Bridges

By **Glenn L. Enke**, Assoc. M. Am. Soc. C.E.
Design Engineer, Morrison-Knudsen Company, Boise, Idaho

COMPOSITE girders of rolled beams and reinforced concrete slabs to form T-sections are ideal for highway bridges. The problem of locking the two materials may be solved if metal shear keys are securely attached to the tops of the beams. Instances are cited from Mr. Enke's practice to indicate that welding is an admirable solution—and in addition has other advantages throughout the structure. The original paper, of which this is a résumé, was awarded a prize in the recent competition conducted by the James F. Lincoln Arc Welding Foundation.

MODERN bridge design demands strict adherence on the part of the designer to economy in the use of materials. In normal times this makes it possible to supply the better highways now demanded within the limits of the highway gasoline tax funds available for the purpose. The present emergency demand for bridge materials in the war effort makes economy still more necessary.

Most bridges, by reason of economy, are of short span and, individually, attract little attention from engineers at large. Collectively, they represent far more economic importance than our most monumental structures, and deserve equal attention. The all-welded composite steel beam and concrete slab bridge type offers substantial economies over other bridge types in the 40 to 100-ft span range. As more than thirty million dollars was spent in the United States during 1940 and 1941 on bridges in this span range, economical methods of construction assume real importance.

Kern River Bridge near Bakersfield, Calif., Under Construction, Showing General Arrangement of Steel

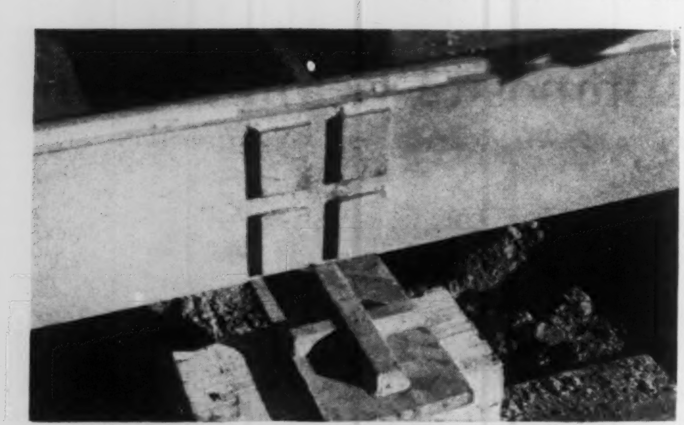
An interesting check on two types of construction was afforded by the recent erection of neighboring structures near Bakersfield, Calif. Both bridges were designed by the writer and built under unit-price contracts for the California Division of Highways in 1941. One, an all-welded structure 1,374 ft long, featured the use of the concrete roadway slab as a top flange, constructed integrally with three lines of rolled steel beams. The typical span length is 61 ft. The bridge is fully continuous between expansion joints, which at the center of the bridge are 392 ft apart. As each pier is fastened to the superstructure with a hinge type of connection capable of transmitting shear, maximum lengths of superstructure without an expansion joint are controlled by elastic stiffness of the piers, which are fixed at their bases to single rows of piling. All joints and splices were designed and welded in accordance with American Welding Society (A.W.S.) Specifications.

By coincidence, this bridge was adjacent to, but on a different highway route from, a shorter (630-ft) bridge using 59-ft 6-in. spans. Both cross the Kern River, have identical piers, approximately equal spans, and were advertised for bids within a three-month period during 1941. They are within two miles of each other. Both had steel shear keys attached to the girder flange for bonding the concrete slab. The shorter bridge is on a federal-aid highway route, however, and could not employ welding throughout, because the specifications of the American Association of State Highway Officials do not recognize welding for main stress-carrying members.

This means that the concrete slab on the shorter one was not assumed to be under composite action to resist dead load. Such action was permitted, however, for live load because it appeared improbable that the structure would ever be subjected to maximum live loads. Considered together, these bridges therefore afford an interesting comparison between an all-welded design with full composite action of the concrete slab (longer structure) and a riveted design, with a limited amount of welding on secondary members and relatively little use of the slab in composite action (shorter structure).

Unit price bids on these structures were quite close, as might have been expected. If anything, those on the shorter were lower; this was true of the steel fabrication and the concrete yardage in place. Erection of steel was the same, per pound. The quantities, likewise the total costs, were closely in the ratio of 2 to 1, or approximately proportional to the lengths. Because it included a cantilevered sidewalk, the longer bridge was 35 ft 6 in. wide instead of 30 ft 4 in., the width of the shorter structure.

These figures indicate that the comparison of costs per square foot should be a fairly good gage of the relative economies of full welding, with composite steel and concrete girders, versus partial welding, with limited use of composite girders. The considerable financial advantage of welding is then demonstrated by the over-all total costs—$3.54 per sq ft for the longer as compared with $4.35 for the shorter. Had the shorter structure employed no welding whatever, and ignored the stress-carrying possibilities of the concrete slab, the unit cost would have been even greater. The latter method, however, represents current practice in most state high-



WELDED PIER BEARING ASSEMBLY PRIOR TO ERECTION

way organizations. So much for the economy of welding; in what follows emphasis will be limited to technical rather than cost advantages.

Experience in welding the heavy longitudinal wide-flange beams was instructive. Plans called for a normal field clearance of $2^{1}/_{4}$ in. between ends. Into this space a 2-in. bar was to be fitted and the whole connection welded into a field splice. If this clearance varied, stock widths of bars varying by $^{1}/_{4}$ in. were available, to insure a field welding clearance on both sides of the bar of not more than $^{1}/_{8}$ in. Instead, the contractor elected to mill the rolled girder beams of 61-ft span to exact length, to obtain a $^{1}/_{8}$-in. field welding clearance, rather than to use the filler-bar arrangement shown on the plans. Difficulties arose because joints had been milled prior to shop welding shear keys to tops of girders. The resulting deformation, which had not been allowed for in milling, produced joints that did not match up to give a uniform $^{1}/_{8}$-in. clearance. Further difficulties appeared in erection, as the lack of field clearance did not allow the usual adjustment in longitudinal position necessary at each pier. It was agreed on the job that the filler-bar arrangement was preferable to the one used.

A second all-welded composite bridge was constructed in the foothills east of Pasa Robles, Calif., across San Juan Creek, 260 ft long, using 58-ft spans. Joints in this bridge used the filler bar, but other difficulties arose due to rather poor fabrication. A noticeable shop error was scarfing the bottom flanges of the rolled girder beams from the under, instead of the top side. This required all overhead welding on the bottom flange splices instead of downhand flat welding as had been planned.

POSSIBILITIES OF COMPOSITE GIRDERS

Welding offers large economies in both the design and construction of composite steel-beam and concrete-slab bridges. This form permits the concrete slab to be used as the top flange of a T-girder section.

Few such composite girder bridges have been built because, among other reasons, the expense of an adequate riveted shear connection between slab and girder is prohibitive. As here described, satisfactory construction details for this type of bridge have been developed, using an all-welded design. Of particular note are the butt welded field splices for heavy rolled beams and welded shear keys. These structures are the first of their particular kind to the best of the writer's knowledge.

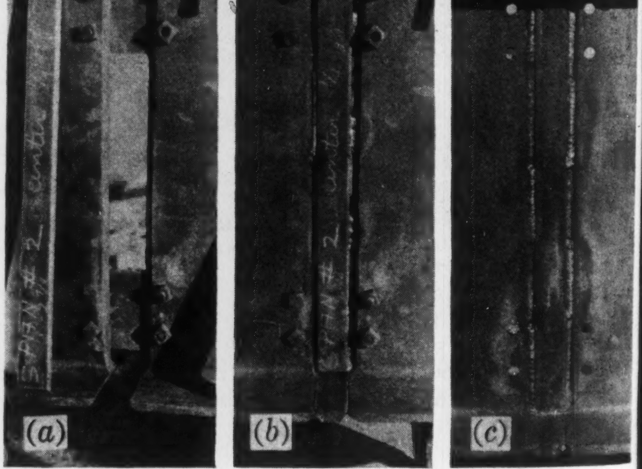
Rolled-beam and riveted-girder spans represent one of the earliest modern types of bridges. Scientific development of design and construction of reinforced concrete to its present high standard has led to the use of concrete deck slab supported on longitudinal steel girders. This type is the most successful one ever developed, as "time" changes in the concrete slab due to plastic flow produce transverse deformation only and do not affect the surface riding qualities of the bridge.

Plastic flow of reinforced concrete subjected to high compressive stress produces an appreciable amount of deformation over a period of years. In shallow members subjected to dead-load bending stresses, the continuous effect of this deformation results in noticeable deflections. A bridge constructed with reinforced concrete members spanning longitudinally (either flat-slab or T-beam design) will in time develop appreciable sags in each span between piers and produce a wavy deck surface with objectionable riding characteristics. This problem is not easily solved in concrete design because the total deformation is not limited, being in general proportional to time and unit stress and inversely proportional to bending stiffness. Short spans and deep members appear to provide the only practical cure, as the total amount of deformation accumulated is then within the limits of usual construction accuracy and of deck smoothness as apparent to the user.

Shallow-slab span designs in the 20 to 30-ft span range have suffered from this phenomenon, beginning their useful life slightly crowned, and ending it with a center-span sag too great for riding comfort and safety. The only reasonable cure at this stage is an asphalt topping, which increases dead load and decreases usable live-load capacity.

Structural steel bridges with longitudinal girders supporting concrete deck slabs with transverse reinforcing overcome all the ill effects of plastic flow. As the modulus of elasticity for structural steel, at 29 to 30 millions, is controlled much more accurately than concrete, which ranges between 3 and 6 millions, deck deflections in a longitudinal direction are accurately allowed for and maintained, as structural steel is not subject to time deformation, that is, plastic flow.

The transverse-span concrete deck undergoes plastic flow of course, but in a direction normal to traffic, pro-



FIELD WELDING OF SAN JUAN CREEK BRIDGE GIRDERS USING FILLER BARS

(*a*) Prepared and Held in Position by Splice Plates, (*b*) Filler Bars Tack Welded, (*c*) Splice Plates Removed and Welding Partially Completed. Note That Bottom Flange Is Incorrectly Scarfed from Lower Side; This Did Not Impair the Joint, But Added Considerably to Construction Cost ducing uniform deformations along any one wheel line or traffic lane throughout the entire length of the bridge. To successfully achieve this effect, cross diaphragms must not be in contact with the concrete deck because uniform deflections and good riding qualities occur only with uniform stiffness of deck in the transverse direction. As smooth riding and good alinement are the only factors of interest to the average user, this feature of all-welded steel composite bridges deserves major consideration.

As noted, development of the composite girder has been retarded because of the expense of developing a good riveted shear key to resist the horizontal shearing stresses under load between the top flange and the slab. Without such positive attachment, the construction is uneconomical and unsatisfactory. That is:

1. The ability of the slab to resist stress must be neglected, and this results in the use of an excessive amount of steel in the girder; also
2. Dead-load deflections cannot be accurately determined. This frequently results in undesirable riding qualities of the finished bridge deck, when a computed (rather, an estimated) deflection fails to materialize, or is excessive. Conversely, a positive shear connection permits an accurate determination of deflection of the composite section, subject only to the usual variation in modulus of elasticity of the concrete.

Welding is ideal to overcome this condition. It permits practically any type of key to be connected to the flange, using fillet welds of proper length and size to develop the horizontal shearing stresses.

PROBLEM OF SHEAR KEYS

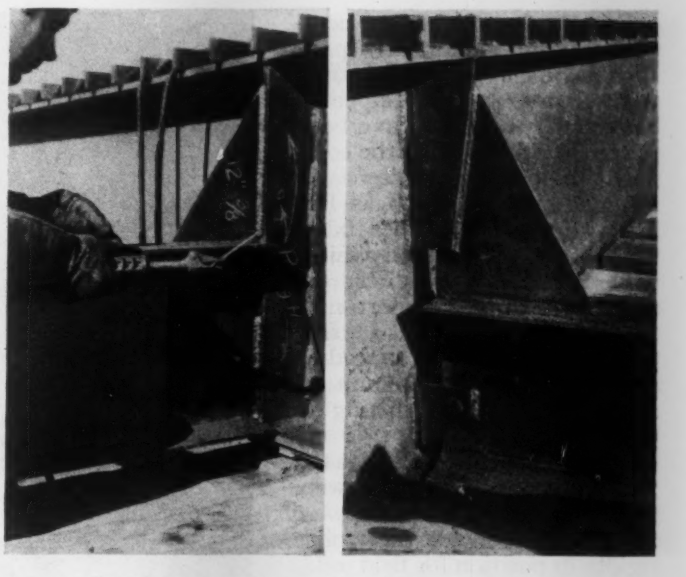
To attach a riveted shear key to a rolled beam requires the drilling of holes in an otherwise blank top flange. This is because all of the deeper, wide-flange sections have a flange too thick to punch. An angle is probably the only satisfactory shear key using rivets; but it requires a horizontal leg of sufficient length and width to accommodate not less than two rivets. The vertical leg, however, is the only useful part of the key. As this vertical leg is subjected to heavy bending stress, it must be fairly thick to permit any reasonable height of angle. As the horizontal leg must be equally thick and of sufficient width to accommodate rivets, 50% or more of the angle is wasted in engaging the rivets rather than in resisting shear.

Z-shapes have sometimes been used for this purpose but they are difficult to obtain owing to infrequent rolling schedules. Then too, they require even more metal. They do serve to lock the slab down to the beam, but this is an advantage more apparent than real, because bending stresses in a beam do not cause vertical separation of the beam elements.

A welded shear key comparable to a riveted angle is a single bar of proportionate height and thickness integrally attached to the flange. No metal is wasted; all of the key is used to resist bearing. A welded key therefore weighs only about 50% as much as a riveted key of equal shear value.

From a practical standpoint, further economies appear. Rivets in an angle must be arranged symmetrically in pairs using not less than two rivets to secure equal loading. This means that the shear-key value changes by increments of 12,000 or 16,000 lb (for $^3/_4$-in. or $^7/_8$-in. rivets, respectively). Welded shear keys, on the other hand, may be proportioned to any value, using a key size and length of fillet weld to meet exact requirements.

Additional waste is therefore present in the riveted arrangement, as it is unusual for both rivets and angles to have equal strengths. Further, angle widths in the desired range vary by $^1/_2$-in. units, whereas flat bars for welding may be obtained from stock in $^1/_4$-in. increments. With the welded key therefore, extreme flexibility in design is obtainable in addition to the saving in weight.



Two Types of Welded Diaphragm Connection

Left, Pier Type Is Attached to Single Full-Height Stiffener Plate; Right, Intermediate Type Is Lap Welded to Two Vertical Plates and Bottom Flange

A butt-welded field girder splice is obtainable quite readily after the following essential precautions have been taken:

1. A nominal 2-in. field clearance between ends of girders is provided for erection purposes.
2. Ends are square cut (either hot sheared at the mill or flame cut in the fabricating shop).
3. Flanges and webs are scarfed for welding. Flanges are scarfed from the top only with a single "V" to permit a large percentage of down-hand welding. Webs are scarfed from both sides for a double-V weld.
4. Filler bars of proper width are inserted into the opening, and field welded to each end of each girder.

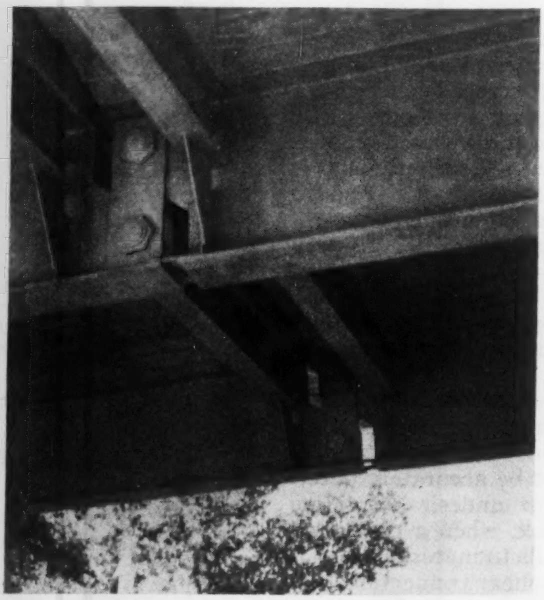
Because of the single-V flange weld, allowable stresses on this type of joint are 85% of the full section, in conformity with American Welding Society specifications. This is ample, however, as the splice is always located near the quarter point in the span, where maximum positive or negative moments for dead load plus live load rarely exceed 40% of the beam strength. The advantage of down-hand welding is considerable, as overhead welding from staging hung on the beam is difficult and expensive. A final overhead pass is necessary on both flanges after cleaning out of the root of the first down-hand pass.

The nominal 2-in. field clearance requires filler bars $1^3/_4$ in. wide, and of thicknesses equal to flange or web for proper butt welding of the splice. As this 2-in. clearance may vary considerably because of mill cutting tolerances if hot sheared, and temperature at time of erection—stock lengths of bars in widths varying by $^1/_4$ in. are kept on hand, thus insuring a field welding clearance on each side of the filler bars of not greater than $^1/_8$ in. These bars are readily flame cut to length in the field. A tapered filler may become necessary because of camber, a vertical curve, or inaccurate beam cutting. In that event a suitable bar can be flame cut to proper shape on the job with little trouble.

For greatest economy, composite beam and girder spans should be supported at their third points with temporary bents until the slabs have been poured. This permits the composite section to resist nearly full dead load as well as live load. It also furnishes falsework for steel erection which, while not essential, is very desirable; it affords opportunity to jack the beam into exact position at the splice; and it requires a bare minimum of splicing material for fitting-up purposes.

Two small splice plates fastened on one side of the web, with 2 bolts in each plate, were sufficient to hold the splice rigidly in position for field welding. These were removed as soon as tack welding of the filler bars was completed.

Job specifications required that step welding be used and the total amount of weld kept symmetrical about both axes of the beam. The field schedule provided for welding of all splices in any one span and uniformly working from this span in both directions toward a deck expansion joint.



UNDER-SIDE VIEW OF EXPANSION JOINT ASSEMBLY—KERN RIVER BRIDGE

All Connections Except Pins, But Including Pin Plates, Are Welded; Small Bars Welded to One Lower Flange and Extending Across Joint, Prevent Lateral Motion

Temperature and shrinkage stresses in the splices during welding were largely eliminated by providing for a temporary sliding connection on each pier. This procedure also assured an accurate control of temperature stresses in the finished structure. Girders were welded down to the piers only after all splices had been welded, the concrete deck had been poured, and the air temperature had reached a seasonal average.

SOME WELDING DETAILS

The pier bearing was a compact welded plate assembly using a $2^1/_2$-in.-wide rocker bar resting on a base plate. The edges of the rocker were chamfered to prevent excessive edge stresses under beam rotation due to deflection. This construction is much less costly than machining the rocker bar to a large radius and serves the same practical purpose, since the angular deflections at this point due to live load and temperature are extremely small. Small keeper bars prevent lateral and longitudinal slippage and effectively transmit temperature and earthquake stresses to the pier, yet they do not interfere with the hinge action under rotation.

This pier assembly was field welded to a small beam set flush into the top of the concrete pier. Such a beam contains less steel and is far more rigid than a base plate. It requires no anchor bolts and is therefore less costly and more satisfactory. The absence of anchor bolts in the welded assembly is particularly helpful during construction, as a slight misalinement in any direction is of no consequence. The bearing beams must be held to proper grade, which however is not difficult, as the beams bolt through their top flanges to wooden cross struts attached to the pier forms.

A similar but riveted bearing assembly would involve expensive countersinking of rivets and in general produce a weak joint. For this reason, other types of bearings, such as a steel pin between two steel castings, have been more satisfactory than a riveted bearing. The total cost of this welded bearing plate assembly is approximately 20% of the usual cast-steel assembly, and its behavior under working conditions is distinctly superior to that of the cast-steel pin-and-rocker type.

Intermediate cross diaphragms between longitudinal girders in a bridge serve two purposes:

1. To distribute the live loads between the girders when applied eccentrically in the central portion of the span. This eccentric loading results in unequal girder deflections, and creates severe shearing and bending stresses in the intermediate diaphragms.

2. To provide a rigid edge support to the roadway slab at slab expansion joints. This is very important as otherwise the passage of live load across the joint causes high impact and rough riding.

The all-welded diaphragm used in this design was shop fabricated from a 14-in., 30-lb, wide-flange beam and two gusset plates, one at each end, butt welded against the beam flange parallel to the beam web. The intermediate diaphragms were erected with the 14-in. beam supported upon the bottom flange of the girders and the gusset plates lap welded against stiffener plates on the girder webs. Two erection bolts held the diaphragm in position for field welding. Weld positions were arranged to eliminate overhead welding. The roadway slab does not rest on these diaphragms, as it is important that intermediate transverse slab supports be eliminated as far as possible in the interests of a good riding surface.

These diaphragms have proved very satisfactory in the finished structures. The decks are noticeably more rigid than similar riveted structures under passage of live load in spite of the high ratio of length to span depth. They also show a marked reduction in vibration due to live-load impact. While the rigidity is accomplished principally by ensuring full composite use of the slab with a good type of welded shear key, the all-welded diaphragms play their part in reducing the live-load impact vibration that is noticeable to a marked degree in an all-riveted span.

WELDED COMPOSITE CONSTRUCTION HELPS

Advantages of increased structural rigidity and better riding qualities of the bridge deck are not definable in terms of cost; yet they contribute measurably to a more satisfactory structure from the highway users' standpoint. These advantages are achieved through the use of welded composite steel beam and concrete construction. Further, the service life of this class of bridge is definitely greater than other structural steel types, because all portions of the bridge are functioning together as a structural unit to resist the forces acting upon it.

Unfortunately, the structures here described have not been in operation long enough to determine their maintenance cost. The writer feels, however, that they will fully justify his expectations for long and continued service.

Ship Prefabrication—Limitations and Advantages

By Joseph L. Friedman, Assoc. M. Am. Soc. C.E.
Permanente Shipyards, Richmond, Calif.

PRAGMATIC civil engineers who are engaged in helping to perfect modern shipbuilding technology have been known to raise the important question, "How far can we profitably go along the prefabrication path?" It is a question to make us stop and think. Where, if at all, does the law of diminishing returns begin to operate in ship prefabrication? We don't know yet. We haven't gone too far along the path at this date. But we keep our eyes open as we proceed, and an occasional review of ground covered does no harm.

First, it might be a good idea to answer the question most often put to us by outsiders: "What are the limits to the size of a ship section which can be prefabricated?" As far as we know, the limitations are purely those of equipment capacity in relation to the size and weight of the prefabricated unit. In building EC-2 Liberty ships, we use largely revolving cranes of 45-ton safe load capacity. When two of these cranes, tracked 10 ft from each edge of a 75-ft-wide assembly platform, are used in a combination lift, the distance between the booms in maximum load position is the absolute size limit of the prefabricated unit that can safely be transferred. With capable rigging, the weight limitation is the combined safe load capacity of the two cranes bounding each assembly platform. There are no apparent practical difficulties of assembly that would hamper the attainment of these theoretical maximum lifts.

In actual production-line ship manufacturing, our largest routine lift does not approach these limiting specifications. A typical large and regularly prefabricated Liberty ship section is one of the deep-tank units, two decks in depth, over 56 ft in molded breadth, with a portion of the shaft alley assembled to it. Neither in dimensions nor in weight (70 tons) does it approach the limitations of our equipment.

As to the question of the actual value of prefabrication, the answer is obviously that during a war of shipping supply we do whatever we can to build good ships faster. Yards which pioneered in production-line ship construction found extensive prefabrication to be faster than limited prefabrication. The first of the Permanente Shipyards in Richmond, originally laid out with relatively unassuming assembly methods in view, was soon altered and enlarged because of the quickly proved success of early, comparatively small-scale prefabrication.

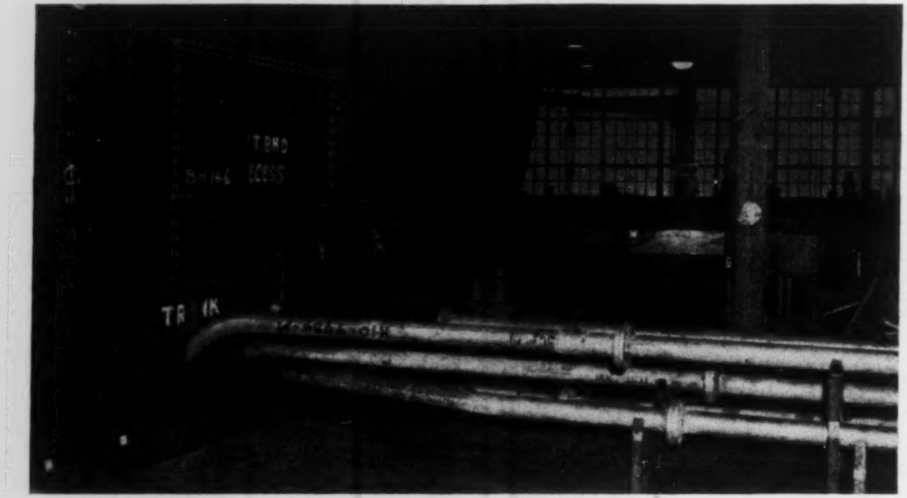
Each of the Richmond yards is now laid out on the basis of a logical construction sequence, allowing steel to progress from a storage area to a plate shop, where plates and shapes are laid out by the use of wooden templates, then rolled, pressed, furnaced, slabbed, punched or cut. From the plate shop, material proceeds by truck crane or flatcar to one of many outdoor major sub-assembly areas before it finally reaches one of the shipways. The keel is being laid and the flatwork is being done on the ways while the sub-assembled units are being prepared. The giant blocks of pre-assembled material are erected as the hull is made ready for them. When most of the steel work has been completed, the hull is launched and outfitting is done—installation of ship's rigging, life-saving equipment, and electrical instruments and gages

Great amounts of sub-assembly work are handled in dispersed locations inside the yard. The greatest feasible labor force is producing simultaneously, without overcrowding, in a number of places: (1) the plate shop for small units; (2) the pipe shop for prefabricated piping; (3) the side shell assembly; (4) assemblies for fore and aft peaks; (5) double-bottom assemblies; (6) boiler, uptake, and stack assemblies; (7) a prefabrication plant which manufactures immense EC-2 deckhouse sections for Permanente Shipyards No. 1 and No. 2.

Plenty of good transfer machinery is needed for this kind of production line. A sample equipment force for a 12-way shipyard would include 23 whirley-type cranes (13 patrolling the 12 assembly platforms and shipways, 5 in the storage area and 5 at the fitting-out dock); 30 truck cranes for transfer from sub-assembly areas to the track-bound shipway whirleys; two locomotive cranes for unloading flatcars and arranging storage areas; and 25 bridge cranes for work in plate, machine, and pipe shops. Miscellaneous equipment would include crane cars, car-loaders, sideboom "cats," jib cranes, A-frame trucks, and specially built large trailers for hauling deckhouse sections.

When modern shipbuilding is reduced to the simple summary represented by a partial list of assembly areas and transfer equipment, one dominant fact seems to

Ship Double Bottoms in a Sub-Assembly Area at Permanente Shipyard



PIPING IS PREFABRICATED TOO; HENCE THIS MOCK-UP ENGINE ROOM AT KAISER COMPANY (RICHMOND SHIPYARD)

stand forth as an explanation of the remarkable speed of the system. That fact is that the work is spread out where many thousands of workmen can get at it conveniently and at the same time. Other factors should, of course, be included: The layout is fitted to the equipment; the equipment is superbly suited to the method; and workmen, patriotically spurred on by the exigencies of war, are coming forward with hundreds of astonishingly fine ideas and inventions—jigs, rigs, gadgets, adaptations, and suggestions.

There are probably limits to exactly how much shipbuilding speed can be accomplished and maintained. We may some day reach those limits, and already we have an inkling of the possible causes of an interrupted increase in future production speed. In reviewing the construction rate of prefabricated ships on the Pacific Coast we find that the first keel was laid in the Richmond yard on April 14, 1941, and the first ship delivered 197 days later. The average keel-to-delivery time of the first five of these British vessels (similar to our EC-2's) was 215 days; of the next five, 189.2. One year after the first keel laying, average keel-to-delivery time, with increased prefabrication, had been cut to 72.4 days. Latest available figures show the current average to be 30 days and a record of 8 days.

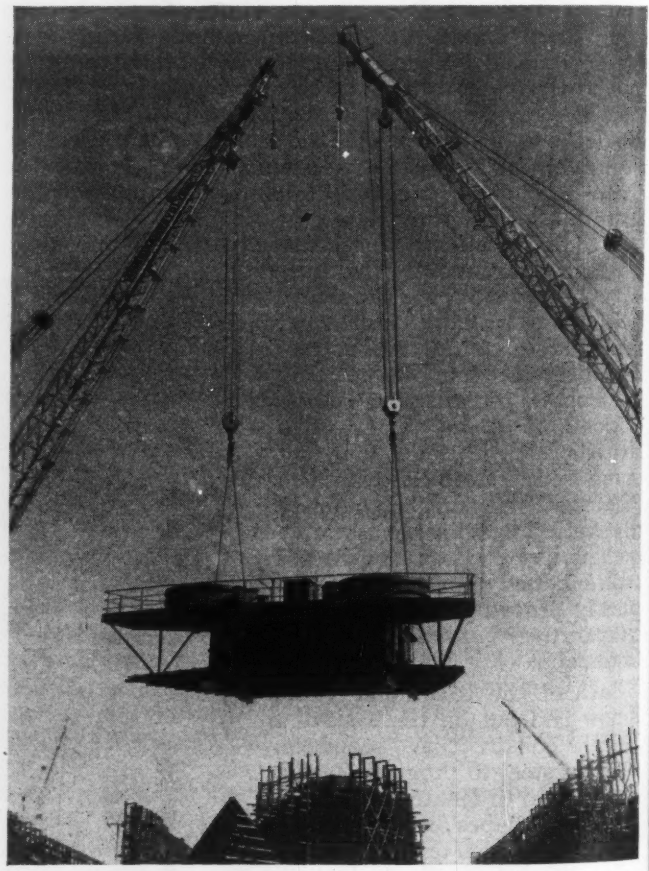
How much more reduction can be accomplished is a question, like the war of shipping supply, still to be settled. After the limits of the equipment have been reached, then the scheduling of equipment, material, and operations will bear the brunt for further increasing construction speed. In these days of supply difficulties, an efficient expediting department whose duty it is to have all material at hand on time is an indispensable aid.

At present, however, the threatening cloud on the horizon of increased shipbuilding speed is not scheduling trouble, but shortage of manpower. If the advantage of prefabricating ships is in the time saving attained by allowing thousands of workmen to get at the work simultaneously, certainly the thousands of workmen are the indispensable factor in the picture. An interesting sidelight on the subject of prefabrication, and in these pressing days a vital problem, is that the man-hours required to construct the first vessels of the Liberty Fleet have been more than halved by the constantly improved construction methods being utilized.

The same asset of prefabrication which gives us speed through employment of a large working force also brings with it the problem of job training for thousands of bellboys, jewelers, gas station attendants, secretaries, professors, laborers, bank tellers, and waitresses. These people must be made quickly into shipfitters, flangers, burners, welders, shipwrights, and electricians. Personnel training schools and conferences conducted in the yards augment on-the-job training, but the task is still a problem because of the high labor turnover due to wartime conditions of housing and transportation, making it necessary constantly to train a stream of newcomers.

One ameliorating feature of this job training problem is the fact that the system of prefabrication breaks jobs down into simple repeated routines, and the all-round journeymen is rarely needed in any but a supervisory capacity. Prefabrication makes jobs easier in another way. Much overhead welding and fitting aboard ship (best done by experienced men) is eliminated; instead, relatively inexperienced men can do this work on the flat in an assembly area. The question as to the value of ship prefabrication is finally answered every time a convoy of speedily built Liberty ships discharges cargo at one of our overseas ports.

The methods and operations which have resulted in this increased productivity were developed under the direction and guidance of Clay P. Bedford, General Manager of the Permanente, Kaiser, and Kaiser Cargo shipyards at Richmond, Calif.



TRANSFER OF COMPLETE AFTER-DECKHOUSE, PERMANENTE YARD

Disposal of Citrus Wastes

Development of By-Products Reduces the Volume of Solids to Be Handled

By Howard W. Hall

Manager, Exchange Lemon Products Company, Corona, Calif.

WASTE from the canning of citrus fruit juices usually approximates 60% of the total weight of the fruit processed. The character of this waste is such that elementary disposal methods are generally unsuitable. To utilize these waste products as well as whole fruit not used for canning, processes have been developed to obtain cattle feeds, commercial acids, and various other products. However, end products still remain that must be disposed of, as explained by Mr. Hall in this paper, which was originally presented before the Sanitary Engineering Division, at the Los Angeles Convention of the Society.

THE problem of waste disposal in plants processing citrus fruit is relatively new. The production of such fruit in the United States has increased very materially during the past twenty years, but the consumption has not increased as rapidly. The result is that during recent years a much larger portion of the total production has been available for processing. The total United States production of citrus fruit in 1920 was 44,461,000 packed boxes; in 1940, it had increased to 141,922,000.

In 1920 the quantity of citrus fruit actually used for processing was very small. During the past ten years large plant facilities have been provided for this purpose. It is estimated that at present something in excess of 800,000 tons of citrus fruit are processed each year. It has also been estimated that something in excess of 400,000 tons of waste products must be disposed of annually—this in addition to the amount of water normally used in their disposal.

TWO GENERAL TYPES OF PROCESSING

The processing of citrus fruit falls into two general categories—canning of juice, and the more complex operations involved in converting the fruit into chemicals. In the latter operations, the fruit is primarily a base material used for chemical manufacturing.

Disposal of the waste products from these two classes of operations presents problems quite different in character. In the usual cannery operations, the waste constitutes approximately 60% of the total weight of the fruit processed, consisting of the rind or peel, together with the internal fiber screened from the juice. A typical analysis of citrus peel is given in Table I.

Liquid effluent from such cannery operations consists very largely of wash water to which at times a detergent has been added, together with the general clean-up water of normal cannery operations. Before present methods of drying citrus peel into stock feed had been developed, it was the practice of canneries to dispose of this peel by hauling it to dumps remotely situated from centers of population, where it was allowed to disintegrate, or in other instances to haul it away from the plant and bury it. In some of the larger plants during recent years the entire waste from such operations, both solid and liquid, is conveyed to large storage beds in which it is allowed to stand and the liquid to evaporate or seep away. The residual material, when partially dry, is used for fertilizer. Some of the larger canneries have in recent years installed facilities for drying citrus peel and converting it into stock feed.

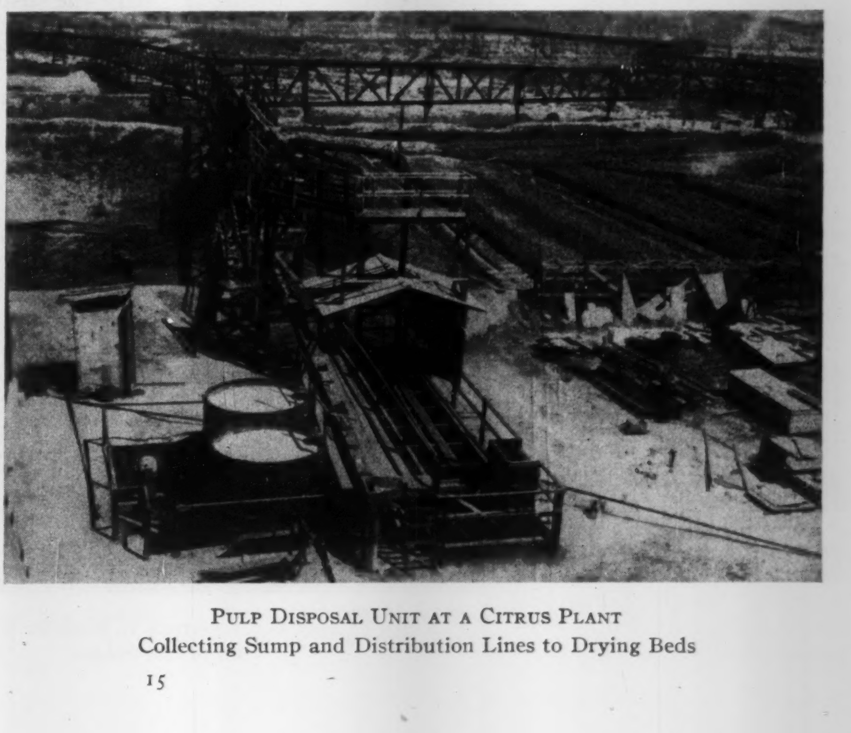
The disposition of cannery wastes from plants operating in Florida is discussed in detail in the bulletin of the Bureau of Agricultural Chemistry and Engineering, of the Department of Agriculture, entitled "Experimental Treatment of Citrus-Cannery Effluent in Florida," with the subtitle, "Food Research Unit Contribution No. 513." This bulletin states:

"At the present time, waste waters from citrus canneries in Florida are disposed of by:

"A. *Emptying into Lakes.* As shown later in this paper this method may cause pollution and destruction of fish life. This danger is particularly present when the body of water is of insufficient area to properly dilute the waste.

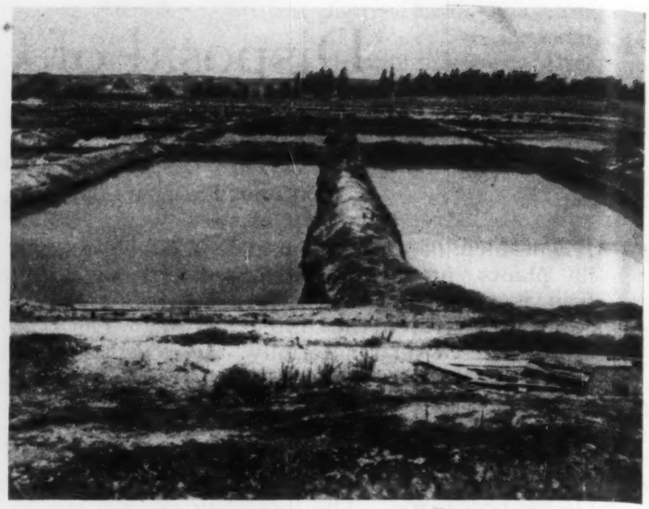
"B. *Handling by City Sewerage System.* In some instances this has caused damage to pumps and piping, clogging of sand beds, and excessive foaming in Imhoff or primary settling tanks. Most cities in Florida are reluctant to handle such wastes.

"C. *Primary Settling Tanks.* This method has not proved satisfactory because retention time is too short and the material shows little tendency to flocculate and settle. The addition of chemicals to encourage flocculation has not yielded effluents of greater purity. Even when the wastes are filtered clear (a practice that would be economically impossible) no significant improvement is shown in the 5-day B.O.D., or oxygen consumed value.



Pulp Disposal Unit at a Citrus Plant
Collecting Sump and Distribution Lines to Drying Beds

DRYING BEDS WHERE PULP IS PREPARED FOR FERTILIZER



EFFLUENT SETTLING BEDS

"D. *Flooding of Waste Lands.* To use this method, an isolated section of land of sufficient area and with a low water table of favorable porosity is necessary. Intermittent application followed by disking is required to prevent ponding. When ponding occurs without preventative measures, conditions become favorable for mosquito and fly breeding. Some canneries using this method of disposition have obtained satisfactory results. Unfortunately, all canneries are not located so that this method can be used.

"E. *Disposing in Tidewater Rivers.* This practice is, of course, limited to those canneries located on the coast. The few canneries so located have not as yet experienced any difficulties, although the danger of polluting shellfish must be kept in mind."

TABLE I. ANALYSIS OF WASTE CITRUS PEEL, ON DRY BASIS

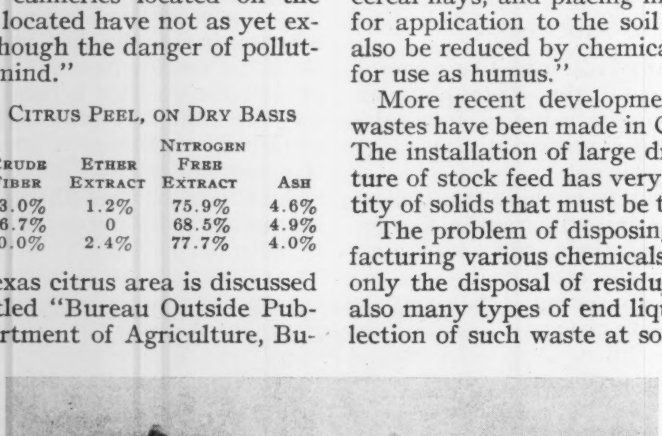
MATERIAL	CRUDE PROTEIN	CRUDE FIBER	ETHER EXTRACT	NITROGEN FREE EXTRACT	ASH
Grapefruit-canning waste..	5.3%	13.0%	1.2%	75.9%	4.6%
Lemon residues	9.87%	16.7%	0	68.5%	4.9%
Orange residues	5.8%	10.0%	2.4%	77.7%	4.0%

Disposal practice in the Texas citrus area is discussed in detail in the bulletin entitled "Bureau Outside Publication No. 3014, U.S. Department of Agriculture, Bureau of Agricultural Chemistry and Engineering." This bulletin states:

"As a result of the operation of citrus processing plants in Texas, it is necessary to dispose of 120,000 tons of solid cannery residue, consisting of peel and pulp, in addition to millions of gallons of liquid wastes, ranging from 1,000 to 80,000 ppm in B.O.D. Improper handling results in odor and insect nuisances.

"In cooperation with the State Board of Health, the value of rapid yeast fermentation as a low-cost, preliminary treatment for screened liquid wastes has been demonstrated. Fermentation converts two-thirds of the soluble solids to volatile substances, at the same time precipitating colloidal material to yield a clear effluent. The yeast sediment from this treatment may be combined with the peel for drying, and clear effluent may be diluted with water for use in irrigation.

"In disposing of the solid cannery residues, an average cost of twenty-five cents a ton for hauling and burying in remote localities would represent an expense of not less than $30,000.00 per year. This material may be used in fresh condition for cattle feed. It may be converted to ensilage by grinding, thoroughly mixing with chopped cereal hays, and placing in silos; and it may be ground for application to the soil as humus fertilizer. It may also be reduced by chemical treatment, or fermentation, for use as humus."

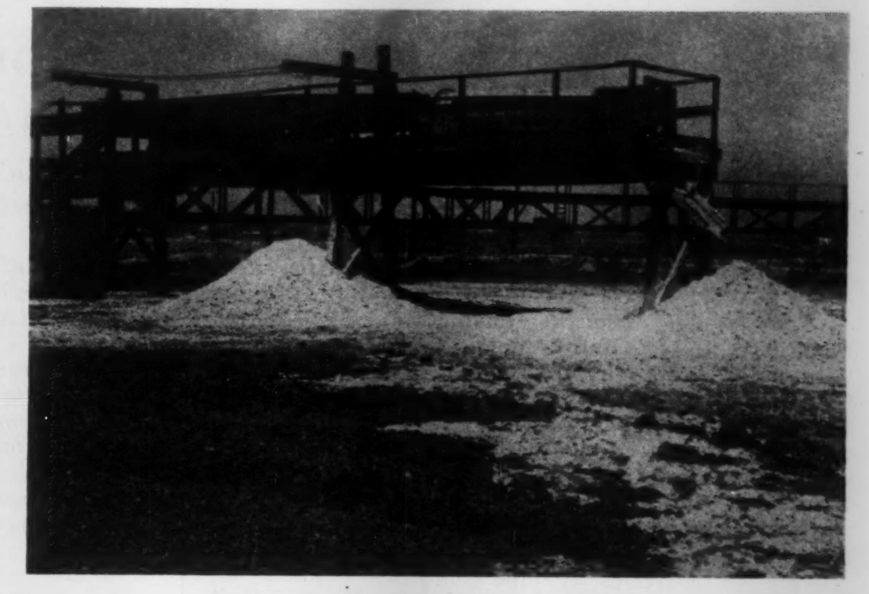


OPEN DRAINS ARE PROVIDED TO REMOVE WATER FROM SUSPENDED SOLIDS

More recent developments in the disposal of citrus wastes have been made in California, Texas, and Florida. The installation of large drying plants for the manufacture of stock feed has very materially reduced the quantity of solids that must be treated as plant waste.

The problem of disposing of waste from plants manufacturing various chemicals from citrus fruit involves not only the disposal of residue peel and internal fiber, but also many types of end liquors. In most plants the collection of such waste at some central point in the plant is accomplished by the use of water. In some plants water is also used to convey all the waste to sewage beds at some distance from the plant. Development in recent years of methods of treating citrus pulp or peel to permit its being dried into stock feed has materially reduced the quantity that must be disposed of as waste.

Methods developed for drying citrus wastes are discussed in several publications of recent years. Briefly, these methods involve the use of some reagent with the peel to promote more rapid action by the enzymes in the fruit or they provide additional enzymes, which assist in



Pulp Discharged from Screen to Bed

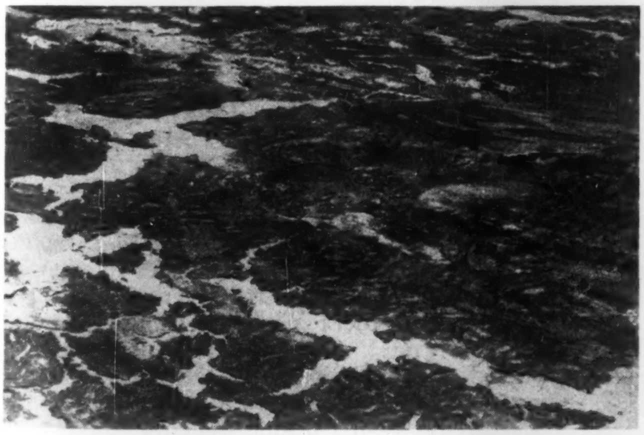
breaking down the pectin into pectates and thus make possible easier elimination by mechanical means of larger quantities of contained water. The treated material, after having been pressed to eliminate as much moisture as possible, is then in a suitable state for drying in regular kiln-type dryers, which may be either direct fired or of the steam tube type. A typical analysis of the liquid effluent from plants in which chemicals are manufactured is given in Table II.

It should be noted that the oxygen demand of this effluent is high compared to that of normal sewage. It should also be noted that there is an appreciable quantity of fiber or cellulose present, representing the finer bits of peel that have been pressed through the screens.

The methods used for disposal by one plant manufacturing products from citrus fruits will be discussed because they are typical. This plant has capacity for processing 750 tons of fruit a day. All waste products, including the peel, are flushed with water to a central waste sump in the plant. From this point the entire mass is pumped through rotating screens (0.050-in. mesh), separating the solids from the liquid effluent. These solids are deposited in large silos or storage tanks and allowed to disintegrate through the action of the enzymes they contain, and through the natural bacterial action that results under atmospheric conditions. As disintegration progresses, trenches are cut through the mass of pulp and the liquid which collects is pumped to settling beds together with the liquid effluent from the screens.

Settling beds are large natural sand and gravel filters affording a high rate of percolation. The beds are filled to a depth of approximately 2.5 ft, and allowed to stand until the liquid has seeped away through the sand filter or has evaporated. The suspended solids, largely cellulose, collect in a thin film on the bottom of the sand filter and when dry are raked off and burned. At intervals the surface of the beds is scarified so that when they are used again the rate of percolation will be satisfactory. Examination of the sand filter bed at various depths shows that the soluble solids of the effluent are quickly decomposed by the natural soil bacteria as it passes through.

A study of the literature and present practice regarding the disposal of waste products from plants processing citrus fruit seems to warrant the following conclusions. In general the problem is comparable with the problems involved in the disposal of other industrial wastes, with special consideration to the peculiar properties of citrus fruit and its products.



Solids Retained on Bottom of Settling Beds Are Easily Removed After Drying

Table II. Analysis of Liquid Effluent from Plants Manufacturing Chemicals from Citrus Fruits

Sample	% in Effluent Grams per 100 cc	% of Total Solids	Ppm
Total solids	1.892	100.00	18,918
Total solids ash	0.357	18.85	3,566
Dissolved solids	1.546	81.74	15,464
Dissolved solids ash	0.309	16.33	3,090
Suspended solids	0.345	18.26	3,454
Suspended solids ash	0.048	2.52	476
Total nitrogen	0.028	1.48	280
Crude protein (N × 6.25)	0.175	9.26	1,750
Nitrogen free extract	1.152	60.90	11,522
Pectin (dispersed in filtered portion)	0.202	10.68	2,020
Crude fiber	0.208	10.98	2,077
Oxygen consuming	...	....	4,800
Crude fiber	60.13% of suspended solids		

The effluent to be treated is usually on the acid side and may show a pH value varying from 4 to 6. In practically all plants disposing of waste products, it is the practice to separate the solids from the liquid and treat them differently. The more recent development of adequate and suitable methods for converting citrus peel into stock food has materially reduced the solid wastes to be handled. The number of products that can be and are being made from citrus fruit has increased during the past few years through research and development work. The resulting changes in operating methods have brought corresponding changes in the chemical constituents of the effluents to be treated.

Operations using sand filters for the final disposition of the effluent require an average of 700 gal of water per ton of fruit processed. The capital cost of such disposal plants will range from $60 to $75 per ton of fruit processed per day, depending upon the capacity of the plant and local conditions. The operating cost of such plants for waste disposal will range from 20 to 26 cents per ton of fruit processed. Efforts to combine the effluent from such plants with municipal sewage for treatment in municipal plants have not given satisfactory results because of the high acidity and B.O.D. of such effluents.

Design of a Petroleum Storage Terminal

Facilities Provided for a Large Bulk Plant on the Eastern Seaboard

By ARTHUR FOX HOLLER, ASSOC. M. AM. SOC. C.E.

SUPERINTENDENT OF CONSTRUCTION AND MAINTENANCE, STANDARD OIL COMPANY OF PENNSYLVANIA, PHILADELPHIA, PA.

DESIGNED for the storage of oil products pending delivery to wholesale and retail outlets, the Schuylkill River Bulk Station of the Standard Oil Company of Pennsylvania is well arranged for flexible operation. In this article Mr. Holler discusses the factors influencing selection of site and arrangement of facilities for a modern plant. In the absence of pipe lines from company refineries, the plant was designed to accommodate water-borne deliveries.

MANY factors influence the design of petroleum bulk storage plants, among them markets, relation to refineries, nature and topography of the country, transportation facilities, and climate. Typical of present-day developments in design and in selection of site is the Philadelphia terminal of the Standard Oil Company of Pennsylvania. In a terminal of this size it is necessary to provide for deliveries by pipe line or ocean steamer as well as by rail in order to secure economical movement of products from the refineries. In Philadelphia no pipe lines from the company's refineries were available or contemplated; therefore it was necessary to choose a site that would permit water-borne deliveries.

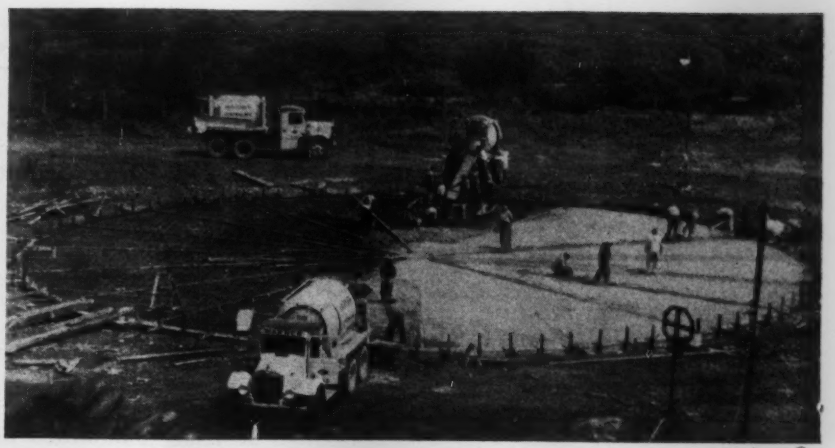
When the layout of the terminal facilities was prepared, it was necessary to consider all existing laws and ordinances in order to obtain the correct tank spacing and distance of structures from property lines and navigable streams. The tentative layout showed that about 38 acres would be required. Selection of the site for a terminal of this size was determined to a great extent by the navigable rivers available and location of fire zones. After diligent search, the only suitable sites were found to be along the Schuylkill River near Harkness Point. The following were then considered in the selection of the site: taxes; laws or ordinances governing construction and operation; real estate values; harbor facilities; navigable channel; tides; nature of river flow and deposits; city zoning; city, state, and government permits; subsoil conditions; drainage; accessible roads; water supply; fire protection; sewage disposal; supply of electricity; railroad facilities; and topography. The site at Harkness Point was finally selected and purchased for immediate development. The first step in developing the plant was the preparation of a final plot plan to meet the requirements of the various governmental agencies and local departments. This plan also had to provide for the most economical operation.

PHILADELPHIA TERMINAL OF STANDARD OIL COMPANY OF PENNSYLVANIA

The tank field was placed between the river and the two railroad sidings so that the receiving units would be as near as possible to delivery points, thereby reducing pumping costs. This location also placed the tanks near the tank-car loading racks. The office, garage, and tank-wagon loading rack were placed at the point of ingress to the plant for quick loading and shorter hauls.

In order to use gravity in moving products to tank wagons whenever possible, the tank-wagon loading rack was placed as close as possible to the motor-fuel and fuel-oil tanks. Gravity loading and unloading is, of course, cheaper and it was desirable to place storage tanks with this in mind. Pipe lines and steamer docks were equipped to pump to the receiving tanks. Tanks for motor fuel and fuel oil (main gallonage products) should be at a high elevation to assure continuous gravity operation and sufficient pressure on the pipe lines for high loading rates. The tank-wagon rack, with dispatcher, was located near the entrance gate and connected by phone to the main office in order to eliminate any delays in loading. The main office was centrally located so that the plant superintendent could see all operations from his office—particularly loading-rack operations. Since tank wagons are occasionally required to pick up deliveries at the warehouse, this was also placed near the tank-wagon loading rack, as well as the garage, for speed in movement of equipment.

Important items in the design of a bulk terminal are the tanks (including foundations), pipe lines, pumping stations, docking facilities, buildings, and compounding plant. There was some difficulty in providing proper tank foundations to carry the concentrated loads, as the tanks would be close to the river and would place a thrust on the wooden retainer. An analysis of subsoil conditions indicated that a spread mat under each tank would not be sufficient to eliminate the possibility of sliding along the river. Pile foundations were desirable in order to penetrate below the average 20-ft depth of river mud. Since a permanent type of construction was desired, reinforced concrete piles were specified, to be cut off and capped with a reinforced concrete slab. This slab has a curb around the edge to retain a 2 or 3-in. sand cushion, and the space between the tank and the curb is sealed with asphalt to keep water from the sand.



Reinforced-Concrete Slab Foundation for a Storage Tank Being Poured Over the Tops of Concrete Piles

For the design of the tanks themselves, a study of vapor losses, preservation of initial quality of product, initial costs, interest on the investment, and maintenance charges, as well as fire hazard and soil bearing pressures was made. This study considered the latest tank designs, including floating-roof, sphere and spheroid, and variable-volume vapor space tanks. As a result noded spheroid tanks were selected for the storage of light products and cone roof tanks for heavy products. The noded spheroid was developed with the demand for larger pressure vessels and has been built in sizes larger than 100,000-bbl capacity and pressures as high as 20 lb per sq in.

All the noded spheroids are designed to an average height of 40 ft (liquid level) and increased capacity is obtained by increasing the horizontal area. This increase of area with increased capacity spreads the load and thereby maintains an even pressure on the soil. The noded spheroid is designed with an outside ring girder as well as internal structural members. The latter include sloping members from the roof to the bottom which serve as tension ties, and columns to support the top, as well as a center support and trusses. This design permits an increase in size by merely introducing curved sections or nodes in the top and bottom. The maximum working pressure for noded spheroids is usually from $2^{1}/_{2}$ to 5 lb per sq in., depending upon evaporation requirements.

This type of tank is well adapted to eliminate boiling losses since the container can be designed to withstand practically any pressure required for petroleum vapor expansion. It is suitable for volatile products such as natural gasoline and butene, or for any product that boils at low temperatures. The fire hazard is reduced since the air-vapor mixture always has a richness above the explosive range. When designed for the proper pressure (depending upon the product), all breathing loss is eliminated and the filling loss that occurs with a cone roof tank is reduced by 50%.

Design of pumping stations was extremely important. Most deliveries to bulk, particularly motor fuels and fuel oils, are from steamers and the fuel is moved into tankage by the ships' pumps. Although it is good practice to utilize gravity where possible, terminal operations are too extensive and pipe-line flow too slow without the use of pumps for loading and for auxiliary purposes. Further, pumps must be used generally to unload tank cars or trailers. Any pump in one-product service can be manifolded for one or more functions. Pumps were located to provide the greatest efficiency with a minimum of power consumption and construction cost.

It is desirable to have explosion-proof, weatherproof electric motor drive. Therefore, weatherproof pumping units and switches were provided, eliminating the necessity for pump houses. Centrifugal pumps were installed whenever possible for they are advantageous from the standpoint of initial cost, speed of delivery, freedom from noise, and power consumption, provided that there is a positive head on the suction side and that the required delivery pressure is not too high. Where positive head on the suction side was not provided (as in the case of naphtha, solvent oils, aviation gasoline, and compounding oil lines), rotary-type pumps were installed. In order to reduce operating costs, remote-control start and stop push buttons are used on the loading racks.

For special services there are innumerable other pumping units such as fire pumps, sump pumps, compounding pumps, lead pumps, and mixing pumps. The fire pump installed is 4-stage, 8-in., centrifugal, of 304-ft head, and 1,200-gal per min capacity, equipped with both a 150-hp electric motor and a 180-hp internal combustion engine. The motor drive will normally be used in case of fire, but an auxiliary power supply should be available at all times to provide against failure of the main current. The fire pump is equipped with a small 100-gal per min priming pump. It can deliver water from the river wherever needed and can boost the city water pressure. It is connected to all plant fire lines for hydrants, fire towers, and foam systems. Fire boats on the river can be connected to this water fire line as required.

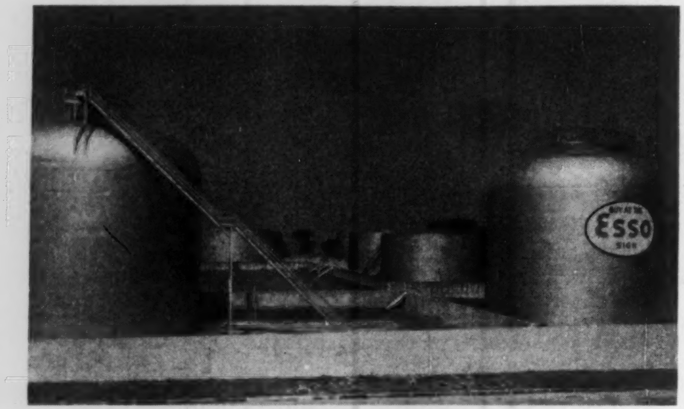
The type of docks built was determined by operating needs and estimated cost. Berths had to be provided for loading and unloading barges and steamers at the same time, and the docks had to carry the pipe lines for all products received or shipped by barge or steamer as well as derricks to handle cargo hose, valves, meters, and other appurtenances.

The area of deck required for each dock was 20 by 60 ft. This was secured economically with wood-frame construction and wood bearing and fender piles, platform, and walers. This type of dock is cheap to construct and is not required to take any thrust, since the impact of the ship is carried by clusters (or dolphins) of wood piles.

Steamer dolphins are located immediately back of the bulkhead and pierhead line. Good practice required at least four clusters of 31 piles each to berth tankers. These piles had to be properly driven since the steamer capstans are often connected to the clusters, which are used as mooring posts for turning in the stream. Unless the clusters are properly designed and constructed, continuous repairs are needed. For the piles, longleaf yellow pine and mixed oak (preferably white oak) were used. The cast-iron bollards, located on shore, were anchored on concrete caps 6 ft deep supported on reinforced concrete piles. It is often economical and desirable to use sheet-steel-pile cylinder docks for tankers.

Reinforced concrete frame buildings with tile walls were used at this terminal for all permanent heated buildings. These include the garage and office building, warehouse building, and compounding building. All steam for heating, compounding, and other uses is supplied by two fire-tube low-pressure steel boilers (one 175.9 hp and one 98.9 hp) located in a boiler room under the office building. The unheated buildings, such as the ethyl mixing building, part of the warehouse building, and the fire-protection buildings, are of steel-frame and sheet-steel design. This is cheaper than masonry and permits the buildings to be moved as required.

As for the compounding building, it is three stories in height with reinforced concrete framing to provide support for suspended tanks and mixing kettles. Compounding provides lubricants for industry and is an essential part of any large terminal. The oils to be compounded are stored in jacketed heated tanks outside the building, and are pumped from the tanks directly into the compounding kettles.



TYPICAL INSTALLATION OF PETROLEUM STORAGE TANKS SEPARATED BY CONCRETE FIRE WALL
Noded Spheroids in Foreground, Cone-Roof Tanks in Background

In plant layout every consideration was given to reducing the length of the pipe lines to a minimum so as to reduce operating expenses and prevent the retention of excessive quantities in the lines. All pipe lines were designed to provide adequate flow of products without excessive pumping pressures—including viscous products under extreme temperature conditions. Flexibility was also considered important so that, within certain ranges, pipe lines can be changed from one service to another without large replacement costs. It was also extremely important to design the pipe lines for sufficient flow to insure speed in loading and unloading at racks and docks.

For its pipe lines the Standard Oil Development Company uses the following formulas for streamline flow:

$$\Delta P = 6.68 \times 10^{-4} \frac{ZUL}{D^2}$$

and

$$\Delta P = 4.55 \times 10^{-6} \frac{ZQL}{D^4}$$

For turbulent flow, the formula used is

$$\Delta P = 0.323 f \frac{SU^2L}{D}$$

in which the friction factor f is obtained from prepared charts dependent upon the values of D, U, S, and Z, and in which

ΔP = pressure drop, in lb per sq in.
D = pipe diameter, in inches
Z = absolute viscosity, in centipoises
S = specific gravity relative to water
L = length of pipe, in ft
Q = quantity of fluid, in gal per hr
W = weight of fluid, in lb per hr
U = linear velocity, in ft per sec $= 0.00680 \frac{Q}{D^2}$

$$U = 0.000816 \frac{W}{SD^2}$$

Charts have also been developed from which the pressure drop for turbulent flow in pipe lines can be determined directly. Pipe lines in the Philadelphia terminal were designed by means of these formulas and existing product data.

Engineers' Notebook

Ingenious Suggestions and Practical Data Useful in the Solution of a Variety of Engineering Problems

Salvage of Street Railway Rails in Buffalo, N.Y.

By NEWELL L. NUSSBAUMER *and* RICHARD C. WHITE, MEMBERS AM. SOC. C.E.
RESPECTIVELY, COMMISSIONER OF PUBLIC WORKS AND CITY ENGINEER, BUFFALO, N.Y.

IN the spring of 1941 there were in the City of Buffalo, N.Y., about 60 track miles of street railway track which had been abandoned by the International Railway Company when buses were adopted on these routes. The total amounted to about 10,000 long tons of rails, or about 22,400,000 lb.

The work to be done included (1) cutting the pavement to permit removing the rails; (2) removing the rail, and such other parts of the track structure as might be necessary; and (3) refilling the slot so caused with concrete when the adjacent pavement was stone block, brick, or concrete, and with concrete and an asphalt topping when the adjacent pavement was asphalt.

Several methods were used to remove the rails. The first consisted of cutting a slot with air tools on one side of the rail, cleaning out the debris, pulling or burning out spikes and clips, and burning off the nuts on the ends of the tie-rods, spaced at 6-ft intervals, which held the rails of each track together. The rails were then jacked sideways to free them from the undisturbed pavement, cut to required lengths, lifted out of the slots, and laid alongside to act as a barricade until the slots were filled with concrete. This was all done by hand labor with the aid of jacks, but was too slow under wartime conditions for the contractors to finish within the completion dates stipulated in their contracts.

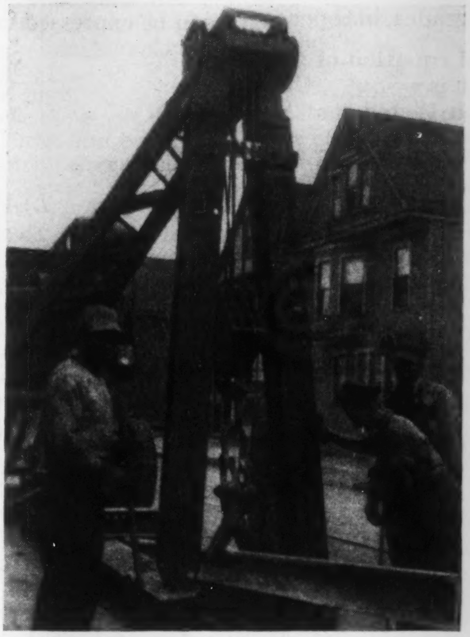
Therefore each contractor experimented with a machine designed to pull up the rail, using the pavement surface as a brace. In each case the saving in time was more than offset by the damage to the adjacent pavement, resulting in excessive replacement. The asphalt surface was pulled free from the concrete or stone base, breaking the bond.

The Lipsett Wrecking and Salvage Company first used the machine shown in an accompanying photograph. The brace beams resting on the pavement were too far apart, and did not fit tightly to the pavement except at the end away from the machine. The slot cut adjacent to the rail was only wide enough to burn off the tie-rods. Pulling rails with this machine under these conditions caused excessive pavement damage. Therefore the machine was remodeled to give better bearing; the slots were cut 15 in. wide; and the tie-rods and spikes were burned off with a torch so that the rail was entirely free from the track substructure before pulling. Then by pulling the rail at a 60° angle to the horizontal rather than vertically, damage to the adjacent pavement was reduced to a minimum. Care was necessary to see that the flanges of the rail did not catch on the asphalt topping.

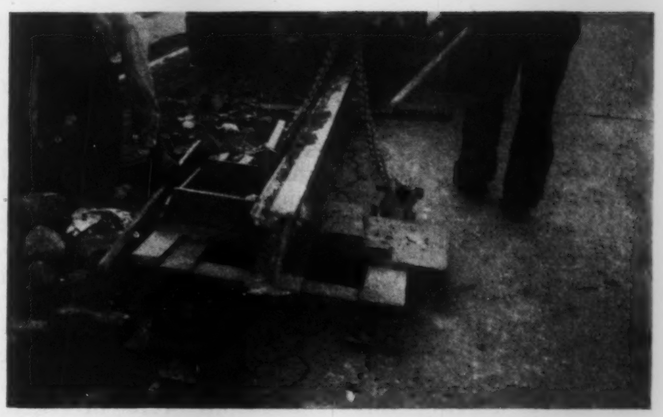
The machine which the Bison Contracting Company first tried was hung from a large platform mounted on wheels, and looked somewhat like a flat car. Power for lifting was provided by 300-lb jacks. Hooks were dropped down from each end of the platform to fasten around the head of the rail, and large beams were dropped down on the pavement to act as a brace. The rails were lifted out without cutting a slot in the pavement. The track construction where this was tried included tie-rods from one rail to the other, and spikes fastening the flanges to the cross ties. In some cases the ties were wood, and others structural channels.

Extreme difficulty was experienced in centering the lifting hooks over the rails. When these were fastened and the lifting took place, the asphalt pavement was lifted free of the base all the way to the curb in many places, and in some cases large areas of base were dislodged with the rail. When the results were observed, the use of the machine was discontinued. The resurfacing placed over this area did not stand up well last summer (1943), probably because of the vibration of the top over the base when subjected to traffic.

The Bison Company then developed the plow device shown in an accompanying photograph. This works very well and causes little damage to the adjacent pavement. The plow consists of two runners of unequal height, and the plow blade above. A slot is cut adjacent to the rail as before. To start the plow, a free end of rail is jacked about 2 ft above the pavement. The high runner rides in the slot, the low one on the adjacent pavement. The rail is set alongside the plow blade, so that, as a large four-wheel-drive truck loaded with stone pulls the plow, the rail is raised free of the slot and then pushed sideways toward the curb. Guided by two men standing alongside, the rail can be dropped beside the slot in a vertical position to form a barricade to protect traffic from the opening in the street. It is necessary to make a 15 in. minimum width of slot when using this device so as not to injure the pavement.



Rail Puller Used by Lipsett Wrecking and Salvage Company



Rail Plow Used by Bison Contracting Company

Where the asphalt surface was in good shape, it was possible to keep a straight edge on the sides of the slots. Where the pavement was scalloped with cracks, it was necessary to remove the loose asphalt in order to get a firm base for the asphalt resurfacing.

In 1942, because of priorities, it was impossible to obtain sufficient asphalt to resurface the track area except on main thoroughfares giving access to war plants. Where the full pavement was stone block, principally on viaduct approaches, the rail slots were filled flush with concrete. Where the track area was stone and the adjacent pavement asphalt, the center slots were filled flush with concrete and the outside ones left depressed 3 in., and then covered with asphalt binder and top surfacing. During the winter the concrete-filled slots raveled, especially at street intersections, and a groove developed between the concrete and the stone block pavement.

In 1943 priorities on asphalt were obtained and approximately 50 miles of track area, 19 ft wide for double track and 9 ft 6 in. wide for single, were resurfaced with $1^1/_2$ in. of binder and 1 in. of asphalt top. This resurfacing has left the streets where the tracks were removed in excellent condition, in many cases practically as smooth as though a complete resurfacing job had been done. In Buffalo the Metals Reserve Company of the Federal Government obtained approximately 8,500 long tons of rails for the war effort. Because of the manner in which the rails were removed, about 75% of the material was used for re-rolled steel. The other 25% was utilized as scrap. In addition, a quantity equal to about 1,500 long tons was salvaged by the International Railway Company for its own use.

Representatives of the Department of Public Works for the City of Buffalo inspected the work of the track-removal contractors, and supervised the construction of all pavement replacement and resurfacing. Richard White, M. Am. Soc. C.E., City Engineer; Harry M. Glassmire, M. Am. Soc. C.E., Assistant City Engineer; and George Chambers, Civil Engineer, were in direct charge of the work for the city.

Sight Distance on Sag Vertical Curves

By DONALD THOMPSON

CIVIL ENGINEERING ASSOCIATE, BUREAU OF ENGINEERING, CITY OF LOS ANGELES, CALIF.

UNTIL recently the determination of the length of vertical curves in sags has depended to a large extent upon the judgment of the individual designer. Light was thrown upon the situation by Pennsylvania Turnpike designers. (See "Design Features—Pennsylvania Turnpike," by Charles M. Noble, M. Am. Soc. C.E., CIVIL ENGINEERING, July 1940, p. 437.) The relationship between headlight sight distance and minimum safe stopping distance was considered to be the ruling factor, and charts solving this relationship were prepared. Sight distance on sag vertical curves can however be calculated by the use of formulas. As far as the author knows, such formulas have not been previously published. It is assumed that the headlights are 2.5 ft above the pavement, and that the beam diverges upward from the longitudinal car axis at an angle of 1°. Two cases follow:

Case 1: When $S < L$, $L = \dfrac{AS^2}{5 + 0.035\,S}$

Case 2: When $S > L$, $L = 2\,S - \dfrac{5 + 0.035\,S}{A}$

in which
S = sight distance, in ft
L = length of vertical curve, in ft
A = algebraic difference in grades, in ft per ft

For Case 1, when $S < L$, the general equation of a parabola with the vertex as shown in Fig. 1, is $y = ax^2$. Coordinates of point O are $y = 2.5 + S \tan 1°$ and $x = S$.

Substituting in the general equation and solving for a,

$$a = \frac{2.5 + 0.0175\,S}{S^2} \text{ and } y = \frac{(2.5 + 0.0175\,S)}{S^2}\,x^2$$

Taking the second derivative of this equation with respect to x,

$$\frac{d^2y}{dx} = \frac{5 + 0.035\,S}{S^2}$$

The second derivative is the rate of change in the slope of the tangent per foot, from which

$$A = \frac{d^2y}{dx}\,L \text{ and } L = \frac{AS^2}{5 + 0.035\,S}$$

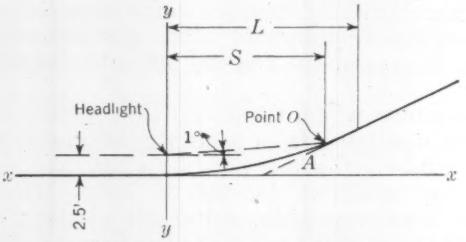


FIG. 1. RELATIONSHIP BETWEEN SIGHT DISTANCE AND LENGTH OF SAG VERTICAL CURVE

For Case 2, when $S > L$, the y coordinate of point O can be expressed in two ways:

$$y = 2.5 + 0.0175\,S, \text{ and}$$

$$y = \frac{AL}{2} + (S - L)A$$

Equating,

$$\frac{AL}{2} + (S - L)A = 2.5 + 0.0175\,S \text{ and}$$

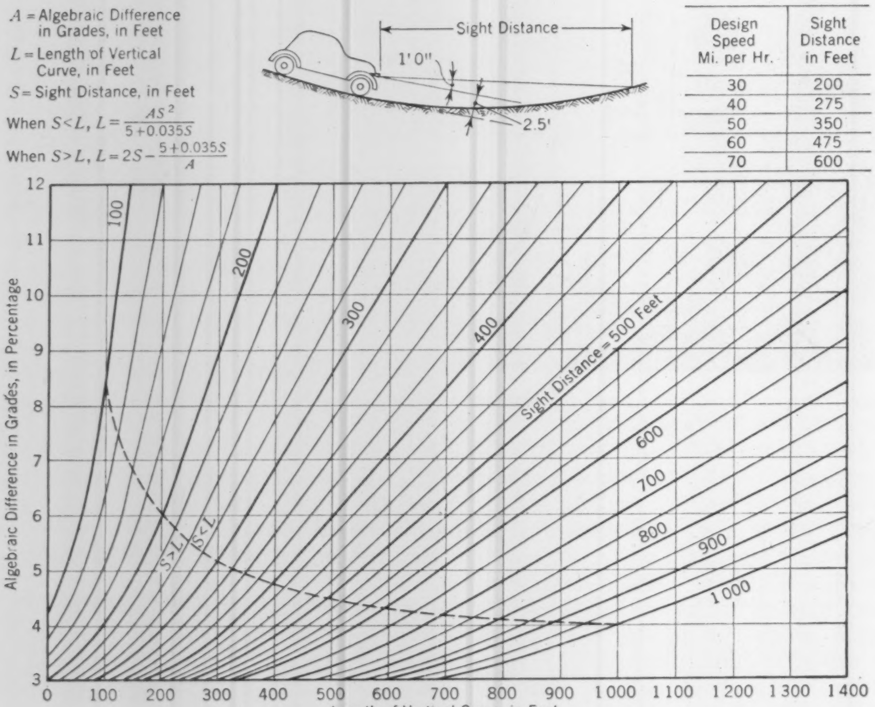
$$L = 2\,S - \frac{5 + 0.035\,S}{A}$$

The accompanying chart (Fig. 2) has been prepared for the use of the City of Los Angeles, Bureau of Engineering. A chart is much more convenient for solving this problem, since without it a preliminary calculation must be made to determine which formula applies.

The minimum safe stopping distances recommended by the American Association of State Highway Officials are:

DESIGN SPEED	SAFE STOPPING DISTANCE
70 miles per hr.	600 ft
60 miles per hr.	475 ft
50 miles per hr.	350 ft
40 miles per hr.	275 ft
30 miles per hr.	200 ft

Sag vertical curves which have a headlight sight distance equal to the minimum safe stopping distances recommended, will be considerably longer than curves designed only from the standpoint of comfortable riding.



Design Speed Mi. per Hr.	Sight Distance in Feet
30	200
40	275
50	350
60	475
70	600

FIG. 2. CHART FOR DETERMINING HEADLIGHT SIGHT DISTANCE ON SAG VERTICAL CURVES

Revision of Pennsylvania Turnpike Commission Chart

OUR READERS SAY—

In Comment on Papers, Society Affairs, and Related Professional Interests

Collective Bargaining

COMMENTS on Society policy, either favorable or critical, are at all times welcomed. Rules established for CIVIL ENGINEERING *provide, however, that critical comments addressed to the editor shall be published only when paralleled in the same issue by remarks prepared by the Chairman of the Society unit most intimately concerned. Such comments from a Life Member in California, concerning the recent action by the Board of Direction recommending that Local Sections amend their constitutions so as to provide for collective bargaining groups in their respective areas, were sent to the editor and are here reproduced, accompanied by a response prepared by the chairman of the Committee on Employment Conditions, which committee recommended the action.*

MY DEAR SIR: After almost a century of effort toward establishing the profession of civil engineering as one of the "learned" group (along with law, medicine, and religion), benefiting mankind, the Board of Direction of the Am. Soc. C.E. has now decided that engineers must become "unionized" for the protection of their right to employment. And it proposes that their "union" shall be the Society.

The Board accepts the legal views of the Committee on Employment Conditions as to the interpretation of the words "professional improvement" (among the objects of the Society) and of Article 9 (on Local Sections) of the Constitution, notwithstanding the fact that the "interpretations" may seem strained—even "Frankfurterish."

The action of the Board seems sudden and abrupt.

Neither the letter of President Whitman nor the report of the Committee on Employment Conditions (in CIVIL ENGINEERING for November 1943) seems to cover some important considerations as to the usefulness of the secondary road, or "bypass," decided to be taken hereafter.

Does it lead into the morass of "jurisdictional disputes," from which rescue is only to be had by "affiliation" with the A. F. of L. or the C.I.O.? And what about "closed shops?"

Is it believed that the Am. Soc. C.E. union can go forward alone on it against either or both of these established unions?

Is it hoped that by cooperation with other professions a third (professional union) party can be built up to have enough power to maintain effective progress in competition with the A. F. of L. and the C.I.O.? (It may be noted that even that successful "Musicians' Union" is reported to be affiliated with one of these.)

There are other problems that will surely arise (though some of these may be left for the moment unsettled), such as "strikes," strike-benefits, strike discipline, dues, "check-offs," etc., etc.

Has a sufficient reconnaissance been made of the "by-pass," covering these and other probably possible obstacles to the professionally minded?

May not the "jump" suggested be one "out of the frying-pan into the fire?"

It would be interesting to know how the British Institute of Civil Engineers has met a similar and even older situation.

The writer feels that this proposal not only abandons all the efforts of the lengthy past but also that it will prove to be a "dead-end" road and neither good for the coming engineers nor for their "professional improvement." He is forced to disagree with President Whitman's last paragraph. "Ye cannot serve both God and Mammon."

Some may agree with the writer and try to pursue the old straight path toward the original goal. *Morituri salutamus!*

Coronado, Calif. W. W. CROSBY, M. (Life) Am. Soc. C.E.

Response by A. M. Rawn

While there is a general concurrence with the Board of Direction's recent action recommending that Local Section constitutions be amended to permit organization of collective bargaining groups, there are critics who declare that the Board has reversed the Society's efforts to obtain professional status for its members. There are yet others who declare that the Society's action is not vigorous enough—that it should go further and establish a militantly aggressive professional union. Both of these possibilities were considered prior to adoption of the course recommended.

What those who feel that the Board's action is not in conformance with the Society's professional attitude fail to understand is that in many parts of these United States, under existing national law, it is not a question of whether the professional engineering employee wishes to join a union, but rather which union or bargaining group he wishes to join. Under circumstances which can be brought about in almost any engineering office, the professional employee can be forced into a union or forced out of his job. This has happened too many times for there to be any doubt about its serious import. The "professional status" of an employee engineer does not safeguard him against having to join a union and be represented to his employer in all matters concerning his employment by individuals who are not representative of his profession.

On the other hand, those who feel that the Board has not taken a sufficiently militant attitude should understand that no person with an engineering education and background would wish to emulate all of the activities of many trade unions. It is the intention of the Committee whose report the Board adopted, and doubtless that of the Board, that a middle course shall be steered: to parallel the activities of unions in so far as they are consistent with the ideas and ideals of the professional engineer; and to be of service and benefit to employee and employer alike—in short, to approach as nearly as possible the kind of group activity which apparently was the original purpose of the national labor laws.

The Board's action is the result of extensive and intensive investigation into labor union activities throughout the United States as they affect professional engineers. The Society has spent several thousand dollars in gathering the facts. They all indicate that resistance to inclusion in unions will not protect the engineer from having to join. His only recourse under the law is to organize with his fellows, elect representatives of his own choosing, and do his bargaining for himself. Some time the law may be amended to exclude from trade unions all members of scientific and learned professions. Until that day arrives, no one can deny that the professional engineering employee is far better prepared to handle his own affairs collectively than to entrust them to others.

A. M. RAWN, M. Am. Soc. C.E.
Chairman, Committee on
Employment Conditions

Los Angeles, Calif.

Above All—Loyalty

DEAR SIR: "Now, let's not be 'God-Saker's!' " This admonition was sure to come when my old construction boss (a Scotchman of much sense, God bless his practical memory) would straighten out us youngsters on the job when things went wrong and someone was apt to shout: "For God's sake, let's do *something!*"

The C.I.O. and A.F. of L. are after our younger Am. Soc. C.E. members. Very properly, we are all deeply concerned. So, for God's sake, do *something.* Unionize this fine organization of ours!

We, who look for a better solution of this tough problem, cannot turn to this sensible old boss for counsel; he has left us for that engineers' heaven where the wicked (C.I.O.) have ceased their torment and the weary (lucky pre-collective bargaining Am. Soc. C.E. members) are at rest.

Our respected Board of Direction has done *something:* a wrong *something* many think—wrong according to the convictions of a large proportion of the 18,000 members of the American Society of Civil Engineers. A friend from high-school days is one Director, and two Directors are former professors to whom I owe gratitude for their efforts to teach me engineering subjects. Thus it is not easy to come out and say that they are wrong. Only an engineering conscience, which despite frequent rebuffs occasionally takes over, obliges me to speak out now.

The collective bargaining proposal is not an ill-considered measure. It is just that consideration appears to have stopped too soon. The fact that several months of hard study went into its development is only an indication of the complexity of this problem. Perhaps the thorough report of the Board's committee should have been accepted as one of progress only, not as the correct, final solution—admitting, too, that the final solution must soon be forthcoming, for we owe our youngest members prompt action in this present problem.

Long discussions of the collective bargaining proposal with men in Boston and New York recently—it seems to have caused more discussion than anything in the writer's 23 years of technical-society activity—indicate that certain of these men have the germ of a solution that is sound. They should present these ideas soon. It should be appropriate to assign time at the Annual Meeting for this, and I shall not anticipate such possible presentation at this time. (An adjourned session of the Business Meeting of the Society, prescribed by the Constitution, will be held on the afternoon of Wednesday, January 19, 1944, for the purpose of full discussion of this topic—*Editors*.)

But I do state that the present proposal to unionize the American Society of Civil Engineers violates beyond all conscience the spirit of its true professional function that has served as my ethical guidepost for two decades.

Too often, we remain silent under the taunt, "Don't be a destructive critic; if you've nothing constructive to offer, keep still!" And too often, measures of doubtful wisdom get by because enough folks do not register their protests when they see the starting axiom of the problem ignored. When, as in the present instance, those assigned to find the answer have turned up with one which is incorrect, it is our duty to assist them by bringing them back to the basic axiom:

"The objects of the Society shall be the advancement of the sciences of engineering and architecture in their several branches, the professional improvement of its members, the encouragement of intercourse between men of practical science, and the establishment of a central point of reference and union for its members." (Constitution; Article 1, Section 3.)

How often perspective becomes distorted as we search for ways to meet present exigencies caused by, frankly, the past decade of political measures that are repugnant to many of us. Ninety-one years ago our Society started with the object of the professional advancement of its membership. Each generation has had its problems. That past generations were faithful to their trust—maintaining inviolate the ideals of the founders while still keeping the organization up to date—is evident from the respect paid the American Society of Civil Engineers today, and in our present huge membership.

These members joined a professional society, not a union. Some of these members have become so deeply concerned at the present unionization proposal that they are considering their resignations. Such men must be requested to stop such defeatist thinking. Commendation is due such men for wanting to keep the Society on its main-line track, but they must be told that they, too, are flirting with the wrong answer when they talk of resignation. They are needed—"in there fighting."

When things go wrong with the water piping in my home, I am glad to find a plumber with a union card. It gives me some assurance that I am getting the services of a good mechanic. And I am proud of the fact that my father joined the Brotherhood of Locomotive Engineers some 40 or 50 years ago. He, too, was proud to send his son to a college where he was to seek ways of solving his problems by the exercise of mental rather than manual dexterity. Doesn't the distinction appear obvious?

It is probable that most of the proponents of collective bargaining for this Society regret the situation that makes it, to them, seem essential. These are upsetting times. Somehow, we must meet present conditions realistically. It should be possible to find ways to protect our younger members in a successful manner that will still retain our Society's professional ideals. We must keep things in perspective in this nine-decades-old organization of ours. Let us seek ways to correct the cause; not allow expediency to lead us into measures that later generations of Am. Soc. C.E. members will regret.

We must remember the reaction that comes to political movements that have gone too far—prohibition, for instance.

Men who have adhered to their ideals throughout such upsets fare best in the long run. Likewise, organizations of such men—like the American Society of Civil Engineers.

And you—who are outraged at the collective bargaining proposal—stop this talk of resignation! This is the time when men of your spirit are needed most—"in there fighting" for the younger members of the Society. They need your mature judgment as they seek to make a decent living, as is their due, while enjoying the fine professional atmosphere of the Society which you have enjoyed for years. By helping to find a way to give these young men the powerful support of the Society in a manner that will still preserve its proper professional spirit—untainted by unionism—that is how you can best serve *your* American Society of Civil Engineers. Loyalty demands this effort on your part.

Boston, Mass. E. H. CAMERON, M. Am. Soc. C.E.
Past-President, Northeastern Section

(Perhaps Mr. Rawn's response to Mr. Crosby covers some of Mr. Cameron's comments.—*Editors*.)

Comments on the Venturi Meter

TO THE EDITOR: I have been interested in the discussions on the Venturi Meter appearing in recent issues of CIVIL ENGINEERING. In the Rowland Prize paper by Clemens Herschel on the Venturi Meter (TRANSACTIONS of the Society for 1887), reference is made to Bourdon's anemometer. As stated by Mr. Richardson in the October 1943 issue of CIVIL ENGINEERING, Mr. Herschel again (in 1907) gave credit to Bourdon for the idea of utilizing the Venturi tube to measure the flow of fluids. Bourdon, however, was not the first to so utilize the Venturi tube.

Cleveland Abbe, chief signal officer of the U.S. Weather Bureau, in his report for the year 1887, page 254, states that "The first current meter based on this principle is that of Overdwyn, in 1854." Overdwyn adopted the proportions that were found by Venturi to give the maximum discharge when his tube is applied to an orifice. He also placed a small Venturi tube so that its mouth would lie in the throat of the larger meter and so exaggerated the suction effect. Abbe stated that this idea was experimentally realized by E. Bourdon (see Paris, *Comptes rendus*, 1882, tome 94, page 229), who, however, altered Overdwyn's arrangement by placing the outlet of the small meter in the throat of the larger one.

Illustrations and detailed descriptions of Overdwyn's meters are given in Abbe's report.

University, Ala.

GEORGE J. DAVIS, JR., M. Am. Soc. C.E.
Dean, College of Engineering
University of Alabama

Unit Labor Cost Method Ineffective for Management Purposes

DEAR SIR: The article on "Manpower in Construction" by L. E. Brigham, in the October issue, presents an interesting and instructive viewpoint on that important subject. It is particularly interesting to note that Mr. Brigham has emphasized not only the importance of the economic aspect of "labor management," but that "labor relations" in its broad sense is synonymous with labor management and that the engineer of broad construction experience and "common-sense approach" is the proper individual to administer labor management on large construction operations.

Mr. Brigham states that "it has been found possible to save a third of the labor cost in dollars or man-hours through good labor management." The recent large wartime construction operations have offered an opportunity for the application of construction-management principles on a scale previously unknown. Unfortunately, the extent to which good management could be applied has been seriously handicapped by time limitations due to the emergency nature of the construction work as well as by the influence and pressure of labor unions, labor shortages and surpluses, and wartime regulations and limitations on the use of construction materials and equipment.

The writer's experience with several very large wartime construction projects leads to the opinion that while the opportunity to save one-third of labor costs was certainly evident, it was seldom, if ever, attained. As a rule such savings were impossible because of the conditions previously stated and because practically all the large operations were of necessity carried out under cost-plus-a-fixed-fee contracts, where economic considerations were evidently of secondary importance. How could any contractor apply principles of good management under these conditions, when he was under pressure from labor unions, politicians, and others to hire more men than he needed and to hire them in advance of actual need so that it was necessary for them to loaf or putter around on the job? How could careful estimates, schedules, and other management controls be established and adhered to when plans and specifications were available for only part of the construction work until the job was nearly completed? How could the best management principles be applied when a job estimated to cost 10 million dollars was expanded to cost 50 million dollars and was completed within slightly more than one year? The conclusion is that the results of attempts to apply good management to large wartime emergency construction operations have been extremely disappointing from an economic standpoint. They were perhaps much more successful in the human factors of labor relations.

Chevy Chase, Md.

Henry H. Jewell, M. Am. Soc. C.E.

Summary of Specification Requirements

To the Editor: The interesting article on specifications by Robert T. Retz, in the October issue, recalls to my mind instances where this controversial subject roused the spirit of the contractor to emit words that are not "fit to print."

Now, after almost thirty years of construction experience with considerable time spent in studying, writing, interpreting, and executing many kinds of specifications, I believe that the subject may be summarized about as follows:

1. Who wrote the first specification? The answer is hidden in the mists of antiquity.

2. The fact that all subsequent specifications have been patterned along the lines laid down by the mysterious father of them all has been responsible for a stereotyped set of generalizations and forms of expression, which have made the work of later compilers easy but have surrounded it with a rigidity that has been the cause of much difference of opinion and interpretation.

3. The writers of specifications are usually inexperienced men, not familiar with the work involved, who fail to realize that every job is different in detail and that all specifications must be flexible enough to be interpreted and enforced. It is the conclusion of many with experience in this field that lack of flexibility is largely the cause of trouble with specifications.

4. Placing the interpretation and enforcement of these rigid specifications in the hands of inexperienced men, whose execution is based on a literal interpretation of words regardless of circumstances, has tended to bring about a condition of havoc in the contract world.

5. Some wise concerns, seeing the losses caused by such specifications, have the foresight to demand that specifications be written to fit each particular job, and that they be flexible enough to afford the experienced inspector proper latitude in their enforcement. Properly prepared specifications rarely cause any differences of opinion or trouble among the architect, the engineer, the superintendent, the inspector, and the contractor.

6. Inspectors are often drawn from the ranks of older men, who have had much experience and who are perhaps past the period of violent construction activity, but whose character is unquestioned and whose judgment is ripe.

7. Many of those who have been in close contact with some of the construction work that has been going for the past three years, are quite convinced that considerable money could have been saved without loss of time, had there been adequate specifications.

8. The problems of the poor specification writer are akin to the problems of the contractor in his contract with the young inexperienced inspector and the man in charge of the work, trying to work together in that broad field of contractural activity with which the contractor only is familiar.

9. The average contractor of some years experience is basically honest but, like many of us when we see some one else getting away with something, succumbs to the temptation to do likewise. Like most of us also, when forced to the wall, he will strike out in self defense. And when that happens, the contractor, being so much wiser in the game, finds it relatively easy to get in his own way what he thinks is rightfully due him.

10. The best inspectors and specification writers are those of good character and sound judgment who have had many years of experience and training in most of the activities of construction work.

Washington, D.C. John F. Miller

Analysis of New WPB Lumber-Stress Directive 29

Dear Sir: The WPB Directive No. 29, increasing by 20% the allowable stresses for structural lumber, became effective on November 1, 1943. (See Civil Engineering for September 1943, page 452.) Analysis of this directive by the Technical Division of the National Lumber Manufacturers Association has revealed the breadth of this action. Study has indicated that the increase in allowable stresses is more than justified. Although the order applies only to work constructed, financed, or approved by government agencies, these classifications include virtually all the buildings now being constructed.

Directive 29 and its specifications do not necessarily conform to all city and state building codes. Where there is a conflict with a building code, the WPB directive and specifications must be observed or the material will not be released for the building. A careful analysis—made by the U.S. Forest Products Laboratory, the War Production Board, and the Technical Advisory Committee of the National Lumber Manufacturers Association—indicated that the increased stresses are entirely safe and can be used with assurance.

While the so-called factor of safety has thus been reduced, the WPB specifications give in detail, and require the use of, correct principles of design and construction and provide for the posting of the structure against overloading. Therefore, since less is left to chance, the factor of safety may be adjusted so as to make a smaller allowance for indeterminacy than previously without in any way reducing the safety of structures. Each factor has been considered separately. Consequently provision was made for the condition where all adverse factors occur simultaneously. Permutations and combinations show that the chance of all adverse factors occurring simultaneously is remote.

The additional increases in stresses for snow, wind, and other short-time loads are based on the known physical behavior of wood under load. The allowable design stresses for lumber and loads for fastenings ordinarily given are for permanent or long-time loading. However, tests show that lumber and joints will carry much greater loads for a short time than permanently. Consequently a factor is included in the safety factor for purposes of adjusting the test results obtained under short-time loading to a stress basis for permanent loading. Therefore, in order to maintain a given safety of structure, the allowable design stresses should be adjusted upward for loads of short duration as well as downward from short-time test loading in deriving design stresses for permanent loading. Actually the stress increases for loads of short duration such as snow, wind, and so on, required in the specifications, are less than the proportionate reduction made in converting stresses from a test to a permanent loading basis. Hence, the increases for the short-time loads are more than justified.

The War Production Board has stated that, "Working stresses used heretofore with structural grades were conservative," and that "the analysis indicated that the increase in stresses could be safely made without the hazard of failure and that they would prove satisfactory provided the precautionary requirements contained in the specifications are observed."

Also, R. P. A. Johnson, formerly wood consultant for the War Production Board and a member of the technical staff of the Forest Products Laboratory for approximately thirty years, has stated: "While the directive will be mandatory only for the duration, we believe that the stresses recommended will prove sound in practice and will be used after the emergency has passed."

Washington, D.C.

Holman Harvey
*National Lumber
Manufacturers Association*

Native Cane for Reinforcement

TO THE EDITOR: In the November issue Prof. F. N. Menefee comments on my article, "Native Cane Reinforcement in Concrete," which appeared in the August issue of CIVIL ENGINEERING.

In my article I stated that, "Some factors noted in these tests (tension) were that the cane joints seemed to be the weakest point in tension, as any pieces having a joint always broke at that point (joint or node)." This statement was an observed fact, on samples as tested, which may or may not be true for all types of bamboo and under varied load conditions; however, my opinion is that it may not be true in all cases. This may be explained by the fact that at the joint (node) there is a pronounced change in diameter and wall thickness, which makes the effective cross section at this point greater. When full stalks (culms) are used in tension, it would seem that the added section might compensate for the less dense fiber structure and the bendings of fibers and bundles of fibers which are to be observed at the joints. However, when a section is turned to a uniform diameter and a joint occurs within its lengths, it is my opinion that the specimen would break at the joint if placed under tension. This would justify Professor Menefee's assumption that the strain (unit elongation) under all stresses would be greater at the joint, thus affecting the *E* value of the specimen.

In regard to the statement, "When the cane was placed throughout the width and depth of the beam with a clear distance between stalks (culms) of about 1 in., the beams failed at loads considerably lower. Failure was due to horizontal shear, the beam simply cracking on a horizontal line near its neutral axis". Professor Menefee states that this horizontal cracking was probably caused by expansion of the cane and the wedging action of the cane when bond failure occurred. I think the expansion theory can be eliminated because of the fact that green undried cane was used. As to the wedging action, I cannot see how wedging could occur without a resulting horizontal shear transference to the surrounding concrete. Unquestionably the wedging action contributed to the development of the crack. This would still be horizontal shear in a cross direction to the direct shear due to tension change in the cane reinforcement. Actually the stress condition would be very complicated, but the fact that the beam split in a horizontal line shows that horizontal shear was the predominant factor in combination with bending.

My statement that "There were no diagonal shear cracks in the slab near the support," referred to so-called diagonal tension, which is a result of vertical shear and horizontal shear.

My original article was taken from a much longer report made to the Clemson College "Claude W. Cress Research Fund" committee, and the questions presented by Professor Menefee were brought out more fully in that report. I might add also that there are many more data to be collected on the subject. To this end, we are now carrying on a rather elaborate set of experiments, from which it is hoped that more concise and exact data may be assembled.

H. E. GLENN, M. Am. Soc. C.E.
Professor of Civil Engineering
Clemson Agricultural College

Clemson, S.C.

Forum on Professional Relations

CONDUCTED COLUMN OF HYPOTHETICAL QUESTIONS WITH ANSWERS BY DR. MEAD

Currently Dr. Mead gives his answer to Problem No. 16, which was announced in the November issue of "Civil Engineering." The problem states that "An engineer in charge of design and construction of a large plant feels that his employers do not correctly interpret his contract with reference to compensation, and they refuse to pay what he thinks are his just dues under the contract. He enters into an agreement with his employers' contractor to pad the quantities. This results in the contractor's receiving overpayments, which extra sum he turns over to the engineer as compensation. What is the ethics of this situation?"

As stated when Problem No. 16 was submitted, this must be regarded as an ethical problem but hardly as an ethical question. Any man of extensive experience who is trying to base his work on ethical principles would realize at once that extra compensation secured by underhand means, in the belief that his clients were not correctly interpreting the contract, would be both unethical and illegal. The student and the young engineer, who have not had extensive experience and see such things done by older and unprincipled men, may not immediately realize the serious unethical conduct involved.

Two answers to this question were received from engineers of some experience who stated simply (without explanation) that the conduct was unethical. For the benefit of the younger members some explanation is deemed desirable.

A very excellent discussion of Problem 16 is furnished by Ford Egbert, Assoc. M. Am. Soc. C.E., of Galveston, Tex., who points out that the action of the engineer in this problem is entirely wrong because it is contrary:

1. To Rules 1 and 8 of the Society's Codeof Ethics (see page 6 of the Yearbook).
2. To normal moral standards.
3. To Bible standards (See Deut. 25: 13–15; Prov. 11: 1; Micah 6: 11; Prov. 23: 6–7; Matt. 7: 12; Phil. 4: 8).

In the first place, any contract for services should be so clear and explicit that there will be no chance for a misunderstanding. However, if the client fails to pay the engineer in accordance with the latter's understanding of their contract, the engineer's only justifiable recourse after trying to adjust the matter fairly with the client by negotiation is to take it into court to secure his just rights.

In many cases there is a feeling that the compensation paid is not so great as the employee (engineer or other worker) is worth. But it is certainly clear that any employee under any circumstances is not warranted in secretly taking from his client or employer goods or property which he may feel will compensate him for the extra amount.

In the case at hand, the engineer enters into a conspiracy with the contractor to pad his estimates sufficiently so that the contractor will pay him the difference to which he thinks he is entitled. Unquestionably any contractor who entered into such an agreement would feel that he was entitled to some compensation for the risk which he thus took, so that the client would be obliged to pay an excessive amount even if the extra compensation to the engineer was warranted.

Conspiracy between the engineer and the contractor leading to the padding of estimates for any purpose would be a serious infraction of law which, if proved in court, might involve very serious consequences to both engineer and contractor and could not be justified under any interpretation of the contract. In many cases the contractor feels that he is not being justly compensated for the requirements of the engineer; and it would be fully as justifiable for the engineer to enter into a conspiracy to pay the contractor the addition that he feels is due him by padding the estimates above the amount actually due as to do so in his own interest.

The only proper way to adjust a difference in an opinion of this sort is by negotiation or through the courts, and no honest engineer or contractor will attempt through illegal action to secure extra compensation which he imagines is due him.

DANIEL W. MEAD, Past-President and
Honorary Member, Am. Soc. C.E.

Madison, Wis.

Problem No. 18, given below substantially as stated, was suggested by a correspondent who requested that his name not be disclosed. Answers to this question may be submitted until February 5, with answers in the March issue.

PROBLEM NO. 18: *A municipal board which had no capable engineer in its employ hired a firm of consulting engineers to prepare designs, receive bids, and recommend the award for a bridge. The engineer of the company who received the contract on a pound basis, prepared an alternate plan for a structure of better appearance, of equal strength, and fully in accord with the specifications but 8% less in weight. The bridge company's engineer submitted his alternate plan to the consulting firm who turned it down as being likely to injure their reputation, and the alternate design was buried in their files. What else could the fabricating company's engineer do?*

Was the submission of an alternate design of the bridge by the contractor's engineer, after bids had been taken, the proper procedure for the contractor? If so, should the engineer of the bridge company make further attempts to secure the adoption of what he considers a more satisfactory and economical design?

Ninety-First Annual Meeting

Engineering Societies Building, New York, N.Y., January 19–21, 1944

Business Meeting, Prize Awards, Conferring of Honorary Memberships

WEDNESDAY—January 19, 1944—Morning

9:00 **Registration in the Lobby**

10:00 **Ninety-First Annual Meeting called to order in the Auditorium (third floor) by**

EZRA B. WHITMAN, *President, American Society of Civil Engineers*

Report of the Board of Direction

Report of the Secretary

Report of the Treasurer

10:30 **Presentation of Society Medals and Prizes**

The Norman Medal to THOMAS E. STANTON, *Vice-President, Am. Soc. C.E., Materials and Research Engineer, State Division of Highways*, Sacramento, Calif., for Paper No. 2129, "Expansion of Concrete Through Reaction Between Cement and Aggregate."

The J. James R. Croes Medal to CARL H. GRONQUIST, *Assoc. M. Am. Soc. C.E., Associate Engineer, Robinson and Steinman*, New York, N.Y., for Paper No. 2151, "Simplified Theory of the Self-Anchored Suspension Bridge."

The Thomas Fitch Rowland Prize to PAUL BAUMANN, *M. Am. Soc. C.E., Assistant Chief Engineer, Los Angeles County Flood Control District*, Los Angeles, Calif., for Paper No. 2168, "Design and Construction of San Gabriel Dam No. 1."

The James Laurie Prize to THOMAS A. MIDDLEBROOKS, *Assoc. M. Am. Soc. C.E., Senior Engineer, Corps of Engineers, War Department*, Washington, D.C., for Paper No. 2144, "Fort Peck Slide."

The Arthur M. Wellington Prize to MILTON HARRIS, *Assoc. M. Am. Soc. C.E., Major, Army Air Forces Storage Depot*, Los Angeles, Calif., for Paper No. 2155, "Traffic Engineering as Applied to Rural Highways."

The Collingwood Prize for Juniors to RAY K. LINSLEY, JR., *Jun. Am. Soc. C.E., Assistant Hydrologic Engineer, U.S. Weather Bureau*, Sacramento, Calif., and WILLIAM C. ACKERMANN, *Jun. Am. Soc. C.E., Associate Hydraulic Engineer, Tennessee Valley Authority*, Knoxville, Tenn., for Paper No. 2147, "Method of Predicting the Runoff from Rainfall."

The Construction Engineering Prize to CARLTON B. JANSEN, *M. Am. Soc. C.E., Manager, General Construction Department, Dravo Corporation*, Pittsburgh, Pa., for paper appearing in July 1943 issue of CIVIL ENGINEERING entitled, "Submerged Shipways with Steel Sheeting Walls—Constructing the Shipways."

The Karl Emil Hilgard Prize to HAROLD A. THOMAS, *M. Am. Soc. C.E., Professor, Civil Engineering, Carnegie Institute of Technology*, Pittsburgh, Pa., and EMIL P. SCHULEEN, *Assoc. M. Am. Soc. C.E., Senior Engineer, U.S. Engineer Office*, Pittsburgh, Pa., for Paper No. 2137, "Cavitation in Outlet Conduits for High Dams."

The Rudolph Hering Medal to GEORGE J. SCHROEPFER, *M. Am. Soc. C.E., Chief Engineer and Superintendent, Minneapolis-St. Paul Sanitary District*, St. Paul, Minn., for Paper No. 2128, "Experiences in Operating a Chemical-Mechanical Sewage Treatment Plant."

11:00 **Conferring of Honorary Memberships**

Edward H. Connor, *Hon. M. Am. Soc. C.E., Vice-President and Construction Engineer, Missouri Valley Bridge and Iron Company*, Leavenworth, Kans.

Mr. Connor will be presented to the President by E. B. BLACK, *Past-President, Am. Soc. C.E., Consulting Engineer, Black and Veatch*, Kansas City, Mo.

Francis T. Crowe, *Hon. M. Am. Soc. C.E., General Superintendent, Pacific Constructors, Inc.*, Shasta Dam, Calif.

Mr. Crowe, who will be represented by FRED C. SCOBEY, *Director, Am. Soc. C.E.*, will be presented to the President by ADOLPH J. ACKERMAN, *M. Am. Soc. C.E., Director of Engineering, Dravo Corporation*, Pittsburgh, Pa.

Gerard H. Matthes, *Hon. M. Am. Soc. C.E., U.S. Waterways and Experiment Station*, Vicksburg, Miss.

Mr. Matthes will be presented to the President by BORIS BAKHMETEFF, *M. Am. Soc. C.E., Professor, Civil Engineering, Columbia University*, New York, N.Y.

Thomas H. MacDonald, *Hon. M. Am. Soc. C.E., Commissioner, Public Roads Administration, Federal Works Agency*, Washington, D.C.

Mr. MacDonald will be presented to the President by THOMAS R. AGG, *Vice-President, Am. Soc. C.E., Dean of Engineering, Iowa State College*, Ames, Iowa.

11:25 **New Business**

So much interest has been evidenced, both in favor and in disfavor of the recommendation of the Board of Direction that the Local Sections amend their Constitutions to provide for the formation of collective bargaining groups in their respective areas that it has been decided to make that subject the topic of an adjourned Business Meeting. The morning session of Wednesday will recess at 12:00 m. to reconvene in the Auditorium at 2:30 p.m., when the subject's history and prospective functioning will be outlined by the Society's Committee on Employment Conditions and others. A full opportunity for questions and comments will be provided.

Report of Tellers on Canvass of Ballot for Officers

Introduction of President-Elect and New Officers

12:00 **Adjournment**

12:45 **Members' Luncheon**

Because of the prevailing difficulties respecting the food situation, the Wednesday noon luncheon which customarily has been served in the Engineering Societies Building will be held this year in the Grand Ballroom of the Commodore Hotel. The Commodore is located at Lexington Ave. and 42nd St., just east of Grand Central Terminal and about a 10 minute walk from the Engineering Societies Building. Arrangements have been made with one of the taxicab companies to have several cabs cruise past the Building from 12:15 p.m. to 1 p.m. for those who desire taxi service to the Commodore.

Tickets for the luncheon will be $1.50.

In view of the fact that the Student Chapter Conference has been canceled for this year there will be no Student Luncheon. All students are cordially invited to the Annual Meeting, and for those who wish to attend the Wednesday Luncheon, tickets will be $1.00.

WEDNESDAY—January 19, 1944—Afternoon

BUSINESS MEETING

Auditorium

2:30 Adjourned Session of Business Meeting for dicussion of collective bargaining

STUDENT CHAPTER CONFERENCE CANCELED

For many years the Student Chapters in the Metropolitan area have conducted a Student Chapter Conference on Wednesday afternoon. This conference includes the Chapters at Polytechnic Institute of Brooklyn, College of the City of New York, Columbia University, Cooper Union, Manhattan College, New York University, Newark College of Engineering, and Rutgers University.

In view of the abnormal conditions prevailing in engineering schools resulting in an absolute minimum of time available for extracurricular activities, the Executive Committee of the Conference of Metropolitan Student Chapters decided against holding a Conference at the 1944 Annual Meeting.

All members of Student Chapters are cordially invited to attend the Annual Meeting and will be welcome at any or all sessions of the Technical Divisions. It is noted elsewhere in this program that there is a special price of $1.00 for Student tickets to the Wednesday noon Luncheon. Those students who wish to attend the Dinner-Smoker on Thursday evening may purchase tickets at the member rate of $2.00.

WEDNESDAY—January 19, 1944—Evening

DINNER, RECEPTION, AND DANCE

Grand Ballroom, Commodore Hotel

COMMITTEE: L. S. WATERBURY, *Chairman;* CARL H. GRONQUIST

7:00 Assembly

7:45 Dinner

9:30 Reception to the President and Honorary Members

10:00 Dancing

Dinner will be served promptly at 7:45 p.m.

Arrangements have been made for tables seating ten persons, and members may underwrite complete tables. Orders to underwrite a table must be accompanied by check in full and a list of guests.

Tickets will be $6.00 each. Tickets for Juniors, for the dance only, will be $2.00 per couple.

The seating list for the Dinner-Dance will close at 5:00 p.m. Tuesday, January 18, 1944. Those who purchase tickets after that hour will be assigned to tables in the order of purchase. Tickets will be on sale at Society Headquarters until 5:00 p.m., Wednesday, January 19, 1944.

College Reunions Throughout the Week

THURSDAY—January 20, 1944

Luncheon of Chi Epsilon Honorary Civil Engineering Fraternity

For the tenth consecutive year, members of Chi Epsilon, their families and friends, will meet for a very informal luncheon at the Midston House, 22 East 38th St., New York, N.Y., on Thursday at 1:15 p.m. The charge will be $1.50 per person. Make reservations through R. I. Land, 100 East 42d St., New York, N.Y. (Ashland 4-3300), or Room 1610, Engineering Societies Building.

University of Illinois Civil Engineering Alumni Dinner

The University of Illinois Civil Engineering Alumni and their friends will meet for the sixteenth annual informal dinner at 6:30 p.m., on Thursday at the Dinner-Smoker, Commodore Hotel. A private dining-room has been reserved on the same floor as the Dinner-Smoker. Dinner-Smoker tickets are $2 for members and $3 for non-members of the Society. All tickets should be ordered from Society Headquarters, and if you wish to join the Illinois group, send your name to Harold P. Larsen, Room 1610, Engineering Societies Building, New York, N.Y., or to M. N. Quade, Parsons, Brinkerhoff, Hogan and Macdonald, 142 Maiden Lane, New York, N.Y., phone Whitehall 3-0820.

Luncheon of M.I.T. Engineers

Because of alterations being made at the Technology Club, the annual M.I.T. Alumni Luncheon will be held at the Engineers' Club, 32 West 40th St., New York, N.Y., on Thursday, at 12:30 p.m. Please notify the Technology Club (Caledonia 5-7424) as to attendance.

New York University Civil Engineering Alumni Dinner

The annual dinner of the New York University Civil Engineering Alumni will be held at 6:30 p.m. on Thursday at the time of the Dinner-Smoker at the Commodore Hotel. The dinner will be served in a private dining room on the same floor as the Dinner-Smoker. Members of the New York University Student Chapter are invited to the alumni dinner and to the entertainment which will follow. Dinner-Smoker tickets are $2 for members and $3 for non-members of the Society. Tickets for Student Chapter members will be $2. Members of the Society should order tickets direct from Society Headquarters, sending their names to Prof. Douglas S. Trowbridge if they wish to sit with the N.Y.U. group. Non-members of the Society should order tickets from Professor Trowbridge.

Rutgers University Annual Dinner

Rutgers University Civil Engineering Alumni will meet for their annual dinner at 6:30 p.m., on Thursday at the Dinner-Smoker at the Commodore Hotel. Private dining rooms on the same floor as the Dinner-Smoker will be reserved for the reunions. Dinner-Smoker tickets are $2 for members and $3 for non-members of the Society. Members of the Society should order tickets direct from Society Headquarters, sending their names to C. H. Gronquist, Room 1104, 117 Liberty St., New York, N.Y., if they wish to sit with the Rutgers group. Non-members should order tickets from Mr. Gronquist.

FRIDAY—January 21, 1944

Supper Meeting of Cornell Society of Engineers

A supper meeting of the Cornell Society of Engineers will be held on Friday at 6:30 p.m., at the Cornell Club, 107 East 48th St., New York, N.Y. Speakers and program will be announced later. Reservations should be made in advance. Buffet supper $2. All Cornell engineers, whether members of the Society or not, are cordially invited. For further information call Paul Reyneau, Secretary, Cornell Club (Plaza 5-7210).

Thayer Society of Engineers of Dartmouth College

The annual meeting and dinner of the Thayer Society of Engineers of Dartmouth College will be held at the Dartmouth College Club, 37 East 39th St., New York, N.Y., on Friday at 6:30 p.m.

SATURDAY—January 22, 1944

Clarkson College Alumni Association

The annual meeting and dinner of the New York Section of the Clarkson College Alumni Association will be held at the Building Trades Employers Association Club, 26th Floor, 2 Park Ave., New York, N.Y., on Saturday at 6:30 p.m. There also will be an informal luncheon and an afternoon meeting on the same day and in the same place.

Syracuse University Alumni Dinner

Graduates and former students of the College of Applied Science, Syracuse University, will hold an informal dinner at Rutley's, 1440 Broadway, New York, N.Y., at 6:30 p.m., on Thursday, January 27, 1944. Reservations at $1.50 per plate may be secured by writing Elliott D. Lynde, 51 Surrey Lane, Tenafly, N.J.

Sessions of Technical Divisions—All Day Thursday

THURSDAY—January 20, 1944—Morning

HYDRAULICS DIVISION

Auditorium

Boris A. Bakhmeteff, *Chairman, Executive Committee, Presiding*

9:30 **Introductory remarks**

Boris A. Bakhmeteff, *M. Am. Soc. C.E., Professor, Civil Engineering, Columbia University,* New York, N.Y.

SYMPOSIUM ON CAVITATION

Program Arranged by the Hydraulics Division's Committee on Cavitation in Hydraulic Structures

9:40 **Cavitation Fundamentals**

John K. Vennard, *Jun. Am. Soc. C.E., Assistant Professor, Fluid Mechanics, New York University,* New York, N.Y.

10:10 **Discussion**

10:20 **Cavitation Experiences of the Corps of Engineers**

John C. Harrold, *Assoc. M. Am. Soc. C.E., Office of Chief of Engineers, War Department,* Washington, D.C.

10:50 **Discussion**

11:00 **Cavitation Experiences of the Tennessee Valley Authority**

George H. Hickox, *M. Am. Soc. C.E., Senior Hydraulic Engineer, Tennessee Valley Authority,* Norris, Tenn.

11:30 **Discussion**

11:40 **Cavitation Experiences of the Bureau of Reclamation**

Jacob E. Warnock, *M. Am. Soc. C.E., U.S. Bureau of Reclamation,* Denver, Colo.

12:10 **Discussion**

12:30 **Adjournment**

SANITARY ENGINEERING DIVISION

Room 501 A-B

A. Clinton Decker, *Chairman, Executive Committee, Presiding*

9:30 Introductory remarks

A. Clinton Decker, *M. Am. Soc. C.E., Sanitary Engineer, Tennessee, Coal, Iron and Railroad Company,* Birmingham, Ala.

9:35 **Report of the Committee on Sewerage and Sewage Treatment**

Langdon Pearse, *Chairman, M. Am. Soc. C.E., Sanitary Engineer, The Sanitary District of Chicago,* Chicago, Ill.

10:05 **Discussion**

10:15 **Report of the Committee on the Advancement of Sanitary Engineering**

Gordon M. Fair, *Chairman, M. Am. Soc. C.E., Professor, Sanitary Engineering, Harvard Graduate School of Engineering,* Cambridge, Mass.

10:45 **Operations of the Committee on Sanitary Engineering of the National Research Council**

Dr. Abel Wolman, *M. Am. Soc. C.E., Professor, Sanitary Engineering, Johns Hopkins University,* Baltimore, Md.

11:15 **Discussion**

11:25 **Plans for Postwar Sanitary Engineering Works by the City of New York**

Richard H. Gould, *M. Am. Soc. C.E., Director, Division of Engineering, Department of Public Works,* New York, N.Y.

11:55 **Discussion**

12:05 **Address on the Work of the Committee on Water and Sewage Works Development**

Ellsworth L. Filby, *M. Am. Soc. C.E., Field Director, Committee on Water and Sewage Works Development,* N.E.W.W.A., F.S.W.A., A.W.W.A., and W.&S.W.M.A.

12:35 **Discussion**

12:45 **Adjournment**

STRUCTURAL DIVISION

Room 501C

Glenn B. Woodruff, *Chairman, Executive Committee, Presiding*

9:30 **Introductory remarks**

Glenn B. Woodruff, *M. Am. Soc. C.E., Chief Engineer, Utah-Pomeroy-Morrison,* Provo, Utah.

REVIEW AND PREVIEW OF THE STRUCTURAL ART

9:40 **Engineering and Architecture**

Aymar Embury II, *M. Am. Soc. C.E., Architect,* New York, N.Y.

10:15 **Discussion**

10:30 **The Structural Industry**

Miss Elsie Eaves, *Head, Statistical Department, Engineering News Record,* New York, N.Y.

11:05 **Discussion**

11:20 **Search and Research**

John I. Parcel, *M. Am. Soc. C.E., Sverdrup and Parcel,* St. Louis, Mo.

11:55 **Discussion**

12:10 **Adjournment**

THURSDAY—January 20, 1944—Afternoon

CONSTRUCTION DIVISION

Room 501C

Harry O. Locher, *Chairman, Executive Committee, Presiding*

2:30 **Introductory remarks**

Harry O. Locher, *M. Am. Soc. C.E., Secretary-Treasurer, The National Association of River and Harbor Contractors,* New York, N. Y.

2:40 **Activities and Accomplishments of the Seabees**

Capt. Kirby Smith, *M. Am. Soc. C.E., U.S.N.R., Bureau of Yards and Docks,* Washington, D.C.

3:15 **Discussion**

3:30 **Sinking an Inclined Shaft at a Large Iron Ore Mine in Adirondack Mountains**

Fred W. Stiefel, *Assoc. M. Am. Soc. C.E., President, Stiefel Construction Corporation,* New York, N.Y.

4:05 **Discussion**

4:30 **Adjournment**

HYDRAULICS DIVISION

Auditorium

Boris A. Bakhmeteff, *Chairman, Executive Committee, Presiding*

2:00 **Introductory remarks**

Boris A. Bakhmeteff, *M. Am. Soc. C.E., Professor, Civil Engineering, Columbia University,* New York, N.Y.

ADVANCES IN HYDRAULIC DESIGN RESULTING FROM TENNESSEE VALLEY AUTHORITY OPERATIONS

2:10 **Major Hydraulic Objectives**

Theodore B. Parker, *M. Am. Soc. C.E., Head of Department, Civil and Sanitary Engineering, Massachusetts Institute of Technology,* Cambridge, Mass.

2:40 **Discussion**

2:50 **Basic Principles of Hydraulic Design**

George R. Rich, *M. Am. Soc. C.E., Chief Design Engineer, Tennessee Valley Authority,* Knoxville, Tenn.

3:20 **Discussion**

3:30 Performance of Some Hydraulic Structures of the Tennessee Valley Authority

GEORGE H. HICKOX, *M. Am. Soc. C.E., Senior Hydraulic Engineer, Tennessee Valley Authority*, Norris, Tenn.

4:00 Discussion

4:10 Hydraulic Operations of the System of the Tennessee Valley Authority

CLARENCE E. BLEE, *M. Am. Soc. C.E., Chief Engineer, Tennessee Valley Authority*, Knoxville, Tenn.

4:40 Discussion

4:50 Adjournment

SANITARY ENGINEERING DIVISION

Room 501 A-B

A. CLINTON DECKER, *Chairman, Executive Committee, Presiding*

2:00 Introductory remarks

A. CLINTON DECKER, *M. Am. Soc. C.E., Sanitary Engineer, Tennessee Coal, Iron and Railroad Company*, Birmingham, Ala.

SYMPOSIUM ON ENGINEERING PHASES OF MALARIA CONTROL

2:05 In War Areas

MARK D. HOLLIS, *Sanitary Engineer, U.S. Public Health Service*, Atlanta, Ga.

2:30 In Tennessee Valley Authority

WALTER G. STROMQUIST, *M. Am. Soc. C.E., Principal Sanitary Engineer, Tennessee Valley Authority*, Chattanooga, Tenn.

3:10 Discussion

3:20 The Challenge to the Sanitary Engineer of the Return of Tropical Diseases

LT. COL. GAYLORD W. ANDERSON, *Medical Corps, Army Service Forces, Office of Surgeon General, War Department*, Washington, D.C.

3:55 Discussion

4:05 Impact of War on Chicago's South District Filtration Plant

W. W. DEBERARD, *M. Am. Soc. C.E., City Engineer, Department of Public Works*, Chicago, Ill.; and
FRED G. GORDON, *M. Am. Soc. C.E., Senior Filtration Engineer, Department of Public Works*, Chicago, Ill.

4:40 Discussion

4:50 Adjournment

Entertainment Features for Thursday

THURSDAY—January 20, 1944—Afternoon and Evening

EVENTS FOR THE LADIES

2:00 Motion Picture Preview

The ladies are invited to attend the preview of a new motion picture not yet announced to be shown at 2:00 p.m., January 20, by courtesy of Warner Brothers Pictures, Inc., at their new Projection Room at 325 W. 44th St., near 8th Ave. As the seating is limited, tickets will be available only to ladies of the immediate families of Society members in the order of reservation. The preview will start promptly at 2:00 p.m., and those attending will be required to be in their seats not later than 1:55 p.m.

Those attending the preview will find a direct route to the tea at the Hotel Commodore by way of the 42nd St. crosstown surface cars from 42nd St. and 8th Ave. to the hotel at 42nd St. and Lexington Ave.

4:00 Tea and a Talk on Fashions

A tea for the ladies has been arranged for Thursday afternoon, January 20, from 4:00 to 6:00 in the West Ballroom of the Hotel Commodore. A talk on fashions will be given by Mrs. Mildred Kaldor, guest speaker, through the courtesy of Franklin Simon & Co., well-known Fifth Avenue store, "The Oldest Specialty Shop in the Country." Mrs. Kaldor will have many interesting things to say about new and current fashions, with sidelights on the effect of the war on ladies' clothes and what the clothes of the future will be. If possible, some styles will be illustrated by models. Tickets for the tea and talk on fashions are $1.00.

8:30 Dunninger, the Master Mind Reader

Seats will be reserved for ladies in the balcony of the Grand Ballroom of the Hotel Commodore for the performance of Dunninger, the Master Mind Reader. Tickets to the ladies for the evening's entertainment are free. Ladies who attend should arrive promptly and be seated by 8:25 p.m.

DINNER-SMOKER FOR THE MEN

Ballroom, Commodore Hotel

THURSDAY—January 20, 1944—Evening

COMMITTEE: RALPH H. MANN, *Chairman;* JAMES H. GRIFFIN, *Vice-Chairman*

6:30 Dinner

8:30 Entertainment

The annual Dinner-Smoker will be held this year on Thursday night in the Ballroom of the Commodore Hotel, 42nd St. and Lexington Ave., New York, N.Y. Dinner will be served promptly at 6:30 p.m. and will be followed at 8:30 p.m. by an unusual program of entertainment.

The Committee in charge of arrangements for the Dinner-Smoker have been successful in securing Dunninger, the "Master Mentalist" who reads people's thoughts as easily as the average person reads printed words. A very interesting evening is assured.

At the 1944 Annual Meeting several college reunion dinners will be held at the same hotel as the Dinner-Smoker, these groups to join the main group for entertainment. Detailed notices of these reunion dinners appear elsewhere in this program.

Members' and students' tickets, $2.00.

Guest tickets, $3.00.

Ladies' tickets.—Because of the anticipated interest of the ladies in the entertainment to be provided at the Dinner-Smoker this year, ladies will be admitted for the entertainment to begin at 8:30 p.m. A special ticket will be given free of charge to those members accompanied by ladies, as indicated on the registration card. These tickets are to be presented at the balcony of the Ballroom at the Commodore between 8:15 p.m. and 8:30 p.m.

Sessions of Technical Divisions—All Day Friday

FRIDAY—January 21, 1944—Morning

POWER DIVISION

Room 501 A

Herbert J. Flagg, *Chairman, Executive Committee, Presiding*

Program Arranged by Committee on Progress in Power Plant Design

9:30 **Introductory remarks**

Herbert J. Flagg, *M. Am. Soc. C.E., Chief Engineer, Board of Public Utility Commissioners of New Jersey*, Newark, N.J.

9:40 **Design of Hydroelectric Power Stations**

George P. Palo, *Assoc. M. Am. Soc. C.E., Principal Civil Engineer, Tennessee Valley Authority*, Knoxville, Tenn.; and

Constant R. Marks III, *Assoc. M. Am. Soc. C.E., Senior Civil Engineer, Tennessee Valley Authority*, Knoxville, Tenn.

10:10 **Discussion**

10:25 **Civil Engineering Features of Watts Bar Steam Plant**

Adolf A. Meyer, *M. Am. Soc. C.E., Head Civil Design Engineer, Tennessee Valley Authority*, Knoxville, Tenn.

10:55 **Discussion**

11:10 **Structural Features of TVA Hydraulic Structures**

Ross M. Riegel, *M. Am. Soc. C.E., Head Civil Engineer, Tennessee Valley Authority*, Knoxville, Tenn.

11:40 **Discussion**

12:00 **Adjournment**

SOIL MECHANICS AND FOUNDATIONS DIVISION

Auditorium

Joel D. Justin, *Chairman, Executive Committee, Presiding*

9:30 **Introductory remarks**

Col. Carlton S. Proctor, *M. Am. Soc. C.E.*, Corps of Engineers, U.S.A., New York, N.Y.

9:40 **Stability and Stiffness of Cellular Cofferdams**

Karl Terzaghi, *M. Am. Soc. C.E., Consulting Engineer*, Winchester, Mass.

10:35 **Discussion by**

Adolph J. Ackerman, *M. Am. Soc. C.E., Director of Engineering, Dravo Corp.*, Neville Island, Pittsburgh, Pa.

Gerald G. Greulich, *M. Am. Soc. C.E., Consulting Engineer, Carnegie-Illinois Steel Corp.*, Pittsburgh, Pa.

Martin W. Lautz, *Assoc. M. Am. Soc. C.E., Sales Engineer, Bethlehem Steel Corp.*, Bethlehem, Pa.

Robert T. Colburn, *M. Am. Soc. C.E., Construction Plant Engineer, Tennessee Valley Authority*, Knoxville, Tenn.

11:40 **Discussion by**

J. S. Miller, *Vice-President, Dravo Corp.*, Pittsburgh, Pa.

12:15 **Adjournment**

SURVEYING AND MAPPING DIVISION

Room 501C

William N. Brown, *Chairman, Executive Committee, Presiding*

9:30 **Introductory remarks**

William N. Brown, *M. Am. Soc. C.E., President, W. N. Brown, Inc.*, Washington, D.C.

9:35 **Report on Consultation on Geodetic Surveys, Aeronautical Charts and Topographic Mapping in the Western Hemisphere**

Robert H. Randall, *M. Am. Soc. C.E., Consultant, U.S. Bureau of the Budget*, Washington, D.C.

SURVEYS FOR DEVELOPMENT PROJECTS

9:50 **Planner's Viewpoint**

Frederick L. Olmsted, *Olmsted Brothers*, Brookline, Mass.

10:10 **Discussion by**

Albert D. Taylor, *M. Am. Soc. C.E., Landscape Architect*, Cleveland, Ohio.

10:30 **Construction Engineer's Viewpoint**

Arlow V. Ferry, *M. Am. Soc. C.E., Chief Engineer, Black and Veatch*, Kansas City, Mo.

10:50 **Discussion by**

William N. Brown, *M. Am. Soc. C.E., President, W. N. Brown, Inc.*, Washington, D.C.

11:10 **Teacher's Viewpoint**

Philip Kissam, *M. Am. Soc. C.E., Associate Professor, Civil Engineering, Princeton University*, Princeton, N.J.

11:30 **Discussion by**

G. Brooks Earnest, *M. Am. Soc. C.E., Associate Professor, Civil Engineering, Case School of Applied Science*, Cleveland, Ohio.

12:00 **Adjournment**

FRIDAY—January 21, 1944—Afternoon

CITY PLANNING DIVISION

Room 503

John Nolen, Jr., *Chairman, Executive Committee, Presiding*

2:30 **Introductory remarks**

John Nolen, Jr., *Assoc. M. Am. Soc. C.E., Director of Planning, National Capital Park and Planning Commission*, Washington, D.C.

PROSPECTIVE ISSUES IN URBAN PLANNING POLICIES FOR THE POSTWAR PERIOD

2:40 **Proposed Inter-Regional Highway System as It Affects Cities**

Thomas H. MacDonald, *Hon. M. Am. Soc. C.E., Commissioner, Public Roads Administration, Federal Works Agency*, Washington, D.C.

3:20 **Discussion by**

George E. Spargo, *M. Am. Soc. C.E., Executive Officer, Department of Parks*, New York, N.Y.

3:50 **Economic Aspects of Suburbanization Versus Centralization of Cities**

Winters Haydock, *M. Am. Soc. C.E., Chief Urban Planner, National Housing Agency*, Washington, D.C.

4:30 **Discussion by**

Sergei N. Grimm, *Assoc. M. Am. Soc. C.E., Executive Director, Syracuse Housing Authority and City Planning Commission*, Syracuse, N.Y.

Russell Van Nest Black, *M. Am. Soc. C.E., Planning Consultant*, New Hope, Pa.

Philip H. Cornick, *Member of Staff, Institute of Public Administration*, New York, N. Y.

5:00 **Adjournment**

HIGHWAY DIVISION

Room 501C

Roger L. Morrison, *Chairman, Executive Committee, Presiding*

2:00 **Introductory remarks**

Roger L. Morrison, *M. Am. Soc. C.E., Professor, Highway Engineering and Highway Transportation, University of Michigan*, Ann Arbor, Mich.

2:10 Postwar Highway Program

H. S. FAIRBANK, *Deputy Commissioner, Public Roads Administration*, Washington, D.C.

2:40 Discussion

3:00 Traffic Engineering Trends

BURTON W. MARSH, *M. Am. Soc. C.E., Traffic Engineering and Safety Department, American Automobile Association*, Washington, D.C.

3:30 Discussion

3:50 Report of the Committee on Design and Construction of Airport Runways and Flight Strips

FREDERICK E. SCHNEPFE, *Assoc. M. Am. Soc. C.E., Executive Assistant, Public Works Administration*, Washington, D.C.

4:20 General discussion

5:00 Adjournment

SOIL MECHANICS AND FOUNDATIONS DIVISION

JOEL D. JUSTIN, *Chairman, Executive Committee, Presiding*

2:00 Introductory remarks

COL. CARLTON S. PROCTOR, *M. Am. Soc. C.E.*, Corps of Engineers, U.S.A., New York, N.Y.

2:10 Current Activities of the Division

HAMILTON GRAY, *Jun. Am. Soc. C.E., Assistant Professor, Civil Engineering, New York University*, New York, N.Y.

2:25 Relief Wells for Dams and Levees

THOMAS A. MIDDLEBROOKS, *Assoc. M. Am. Soc. C.E., Office of Chief of Engineers*, Washington, D.C.; and WILLIAM H. JERVIS, *U. S. Waterways Experiment Station*, Vicksburg, Miss.

Discussion by

3:10 THOMAS A. MIDDLEBROOKS, *Assoc. M. Am. Soc. C.E., Senior Engineer, Office of Chief of Engineers, War Department*, Washington, D.C.

3:30 WILLARD J. TURNBULL, *M. Am. Soc. C.E., Chief of Embankment, Foundation and Pavement Division, U.S. Waterways Experiment Station*, Vicksburg, Miss.

3:50 ARTHUR CASAGRANDE, *M. Am. Soc. C.E., Associate Professor, Civil Engineering, Harvard University*, Cambridge, Mass.

4:05 DONALD W. TAYLOR, *Assoc. M. Am. Soc. C.E., Assistant Professor, Soil Mechanics, Massachusetts Institute of Technology*, Cambridge, Mass.

4:20 PHILIP C. RUTLEDGE, *Assoc. M. Am. Soc. C.E. Professor, Civil Engineering, Northwestern University*, Evanston, Ill.

4:35 General Discussion

5:00 Adjournment

Trips to Places of Special Interest in New York

During the three days of the Annual Meeting, trips for ladies to places of special interest in New York will be organized as desired. The following places are listed as a suggestion, and most of them are either on 5th Ave. or reached by 5th Ave. bus as well as by other means of transportation. No special transportation can be provided.

Empire State Building Observation Tower

The Empire State Building is at 34th St. and 5th Ave. The tower is open from 8:30 a.m. to 12:30 a.m. The charge is $1.10 per person.

Rockefeller Center

Rockefeller Center, between 5th and 6th Aves. and 48th and 51st Sts., contains several places of interest for which regular guided tours are available. Among them is the N.B.C. Studio—Television Tour, which takes groups actually behind the scenes of radio broadcasting and television. Groups for this tour leave the Studio Section of the R.C.A. Building at frequent intervals, the tour taking one hour and the charge being 55 cents per person, or 40 cents per person for groups of 10 or more. Tickets at the 40-cent rate may be arranged for through the Society, whether by group or individually.

The Museum of Modern Art

The Museum of Modern Art is at 11 West 53rd St., just west of 5th Ave. The regular admission charge is 28 cents.

Starting promptly at 2:00 p.m. on Friday, January 21, a gallery talk and guided tour of the museum, together with the regular film showing in connection with the museum's program of "45 Years of the Movies," followed by tea served in the museum penthouse, will be arranged for through the Society for a group of 10 or more ladies, but limited to 35. The charge to the ladies for tickets for this tour and tea is 53 cents per person.

The regular film showings are at 3:00 and 5:30 p.m. On Wednesday, January 19th, "Harvest," produced in 1939, and on Thursday and Friday, January 20th and 21st, "Cabiria," produced n 1914, are being shown.

Metropolitan Museum of Art

The Metropolitan Museum of Art will provide a special tour by appointment with one of the staff lecturers. This can be a general tour of the museum or of special subjects, such as the Paintings or American Wing. Special exhibitions through January include the George Blumenthal Collection, the Maitland Griggs Italian Paintings, the Greek Revival in the United States, and the photographic exhibit. Admission to the museum is free. A charge of 25 cents per person per hour with a minimum of $1.00 per hour is made for guidance. The museum restaurant serves luncheon up to 2:30 p.m. The museum, which is at 82nd St. and 5th Ave., may be reached by 5th Ave. buses Nos. 2, 3, or 4.

The Frick Museum Collection

The Frick Museum Collection includes masterpieces by old and newer painters, rich furnishings, etc., and is on exhibition in the Frick Mansion at No. 1 East 70th St., just east of 5th Ave., reached by 5th Ave. buses Nos. 2, 3, or 4. Organ recitals are given at 11:00 a.m., 1:30 and 4:00 p.m., and there is a regular lecture at 3:00 p.m. each Wednesday through Friday. Admission is free.

Museum of the City of New York

The Museum of the City of New York is a historical museum of the City. Of special interest to ladies would be the exhibits of costumes, interior furnishings, toy shop, and silverware. The special exhibit in January is "Fun and Folly in New York." A specially conducted tour can be arranged for a group of ladies for a morning or afternoon. The museum is at 5th Ave. and 104th St., and is reached by 5th Ave. buses Nos. 2, 3, or 4.

Cathedral of St. John the Divine

The Cathedral of St. John the Divine is at Amsterdam Ave. between 110th and 113th Streets. The Cathedral, which is still under construction (the cornerstone having been laid in 1892), when completed will be the largest Gothic cathedral in the world. It is open to visitors from 8:00 a.m. to 6:00 p.m., guided tours being conducted at 11:00 a.m., 12:00 noon, 2:00, 3:00, and 4:00 p.m. daily. Enter by the 112th St. entrance, the tours starting from the exhibit hall. The cathedral is reached by 5th Ave. bus No. 4, or by 8th Ave. subway and buses at 110th St., and by Broadway surface car or subway (1 block west at 110th St.).

St. Patrick's Cathedral

St. Patrick's Cathedral, located on 5th Ave. between 50th and 51st Streets, is open to visitors from 6:00 a.m. to 9:30 p.m.

Columbia Broadcasting System, Broadcasts

Ladies from out of town may call at the Columbia Broadcasting System ticket office, 485 Madison Ave. between 51st and 52nd Sts., New York, between 9:00 a.m. and 5:00 p.m., and on presentation of proper credentials showing they are from out of town, will receive tickets for available broadcasts, limited to a maximum of 4 tickets a person.

General Announcements

Hotel Accommodations

New York hotels are very crowded and those planning to attend the meeting are urged to make reservations at once. If you are coming to the Annual Meeting and have not yet made hotel arrangements do so without further delay. Those who come to New York without such reservations may encounter extreme difficulty in finding hotel accommodations.

For Hotel Rates, See December "Civil Engineering"

For list of hotels, with rates, members are referred to the December issue, page 591. Again it must be emphasized that visitors cannot expect to obtain hotel accommodations in New York City unless they have confirmation of their reservations before leaving home.

Headquarters Hotel

The Commodore Hotel has been designated as the Headquarters Hotel for the Annual Meeting. Announcement has been made elsewhere in this program of the Wednesday noon Luncheon, the Wednesday evening Reception and the Thursday Dinner-Smoker to be held at this hotel.

Facilities of the Engineers' Club

Members may use the dining facilities of the Engineers' Club, 32 West 40th St., New York City, on a cash basis. Guest cards for this purpose may be obtained at the Registration Desk. The Club also will be able to accommodate a limited number of members, the price of rooms ranging from $2.50 upward. Requests for reservations should be made in advance and addressed to Society Headquarters.

Information Desk

An Information Desk is provided in the Reading Room of the Society on the 15th Floor of the Engineering Societies Building to assist visiting members in obtaining hotel reservations and theater tickets, and in securing any desired information.

Your New York Address

At the Registration Desk a card file of those in attendance will be maintained, with information as to members' hotel addresses in New York. Members are requested to keep Society Headquarters informed as far as possible of their New York addresses so as to expedite the delivery of telegrams, telephone messages, and mail.

Order Tickets in Advance

Members who order tickets in advance will assist the Annua Meeting Committee greatly by giving advance information to guide it in concluding arrangements. Ticket order blanks have been mailed to each member with the condensed program. No cancellation of tickets can be made after noon of Wednesday, January 19, 1944.

Regional Meeting Committee

This program has been prepared under the direction of the Committee on Regional Meetings, Charles M. Spofford, *Vice-President, Am. Soc. C.E., Chairman;* and R. E. Bakenhus, V. T. Boughton, Charles B. Breed, George W. Burpee, and Dean G. Edwards, *Directors, Am. Soc. C.E.*

Committee on Local Arrangements for the Annual Meeting

Homer R. Seely, *Chairman*

David G. Baillie, Jr.
John M. Buckley
James H. Griffin
Carl H. Gronquist
Alfred Hedefine
E. L. Macdonald
Ralph H. Mann
Joseph O. May
L. S. Waterbury

Junior Members

Archie N. Carter
James A. Lindsey
Edward E. Lustbader
Don P. Reynolds
Benjamin P. Robinson
Woodman F. Scantlebury
Sidney Weniger

Ladies' Committee

Mrs. Homer R. Seely, *Chairman*

Mrs. David G. Baillie
Mrs. R. E. Bakenhus
Mrs. V. T. Boughton
Mrs. John M. Buckley
Mrs. George W. Burpee
Mrs. Dean G. Edwards
Mrs. James H. Griffin
Mrs. Carl H. Gronquist
Mrs. Alfred Hedefine
Mrs. E. L. Macdonald
Mrs. Ralph H. Mann
Mrs. Joseph O. May
Mrs. George T. Seabury
Mrs. Charles E. Trout
Mrs. L. S. Waterbury

Please call on the Committee on Local Arrangements for the Annual Meeting, or on the Secretary's Office, for any service desired.

Meeting of the New York State Sewage Works Association

Hotel McAlpin, Broadway and 34th St., New York, N.Y.

All Members of the Sanitary Engineering Division of the American Society of Civil Engineers Are Cordially Invited

FRIDAY—January 21, 1944—All Day

Ballroom

8:30 **Registration**

10:00 **Annual Business Meeting**

10:45 **Sewerage Developments and Prospects in Canada**
Albert E. Berry, *Director, Sanitary Engineering Division, Provincial Department of Health,* Toronto, Ontario, Canada.

11:30 **Controlled Digestion**
Harry E. Schlenz, *Pacific Flush Tank Company,* Chicago, Ill.

12:15 **Adjournment for luncheon**

There will be no programmed luncheon—a wartime measure.

GREASE REMOVAL SYMPOSIUM

2:00 **Grease Interceptors for Use in or near Houses and Restaurants**
Dean F. M. Dawson, *University of Iowa,* Iowa City, Iowa

Experiences of a Large City with the Grease Removal Program
C. E. Keefer, *Associate Engineer, Bureau of Sewers,* Baltimore, Md.

Grease Removal Ordinances and Grease Problems in Sewer Maintenance
Morris M. Cohn, *Sanitary Engineer,* City of Schenectady, New York; *Editor, Sewage Works Engineering,* New York, N.Y.

Utilization of Sewage Grease
Wellington Donaldson, *Chief, Bureau of Sewage Disposal Design,* Department of Public Works, New York, N.Y.

Discussion

4:30 The Determination of Grease in Sewage
W. D. Hatfield, *Superintendent, Sanitary District of Decatur,* Ill.; and
George E. Symons, *Associate Editor, Water Works and Sewerage,* New York, N.Y.

Discussion

5:15 **Adjournment**

5:30 **Social Hour in Adjoining Winter Garden**

SOCIETY AFFAIRS

Official and Semi-Official

Society Prizes and Medals to Be Awarded

Ten Members to Be Honored at the Annual Meeting for Outstanding Contributions to Society Publications

As usual prizes and medals will be presented by the Society at its Annual Meeting to be held in New York, January 19–21, 1944. Oldest and most distinguished of these Society awards is the Norman Medal, which was established in 1872 by the late Goerge H. Norman, M. Am. Soc. C.E., for an especially original and important contribution to the profession. Next in distinction is the J. James R. Croes Medal, established by the Society in 1912 and named for the first recipient of the Norman Medal.

In 1884 the late Thomas Fitch Rowland, Hon. M. Am. Soc. C.E., established the prize bearing his name for a paper that best describes some accomplished work of construction. The paper adjudged the second in merit to that awarded the Thomas Fitch Rowland Prize receives the James Laurie Prize, which was established by the Society in 1912 and named in honor of the first President.

In 1924 the Sanitary Engineering Division of the Society endowed the Rudolph Hering Medal, which goes to the author of the paper considered the most valuable contribution to the advancement of the sanitary branch of the profession.

The Arthur M. Wellington Prize for the best paper on some phase of transportation was established and endowed by the *Engineering News-Record* in 1921. Award of this prize rests with the Society, although the recipient need not be a member of the Society. In 1894 the Collingwood Prize for Juniors was established by the late Francis Collingwood, M. Am. Soc. C.E., on his retirement as Secretary of the Society.

Conditions for the Hilgard Prize differ somewhat from those for the other awards of the Society. It is given only once in two years, and its administration is under the Society's Hydraulics Division. Consideration is given to the hydraulics papers appearing in each year's Transactions, and then once in two years the recommendation for the award is made.

Biographical sketches of the recipients of these awards follow.

Thomas E. Stanton, M. Am. Soc. C.E., was born in Los Angeles, Calif., on May 31, 1881, and graduated from the University of California in 1904 with the degree of B.S. His professional career has consisted of 7 years with the City Engineering Department of Los Angeles and 31 years with the California State Department of Highways—for the past 15 years as chief of the Materials and Research Department. Long a member of the Society, Mr. Stanton served as president of the Sacramento Section in 1930 and was ex-officio chairman of the Spring Meeting of the Society held there that year. He was Director of the Society from 1937 to 1939 and is now completing a term as Vice-President. Mr. Stanton is a member of numerous other technical societies, and has contributed papers to the proceedings of these societies and to the technical press. One of his papers—published in the 1938 *Proceedings* of the American Concrete Institute—was awarded the Wasson Medal for noteworthy research reported that year. In addition to his technical interests, Mr. Stanton has taken an active part in the establishment of a retirement system for state employees and was one of the founders and first state president of the California State Employees Association.

Carl H. Gronquist, Assoc. M. Am. Soc. C.E., was born in New York City on October 17, 1903. After graduating from Rutgers University in 1925, with the degree of bachelor of science in civil engineering, he was appointed a graduate assistant in civil engineering at that institution. In 1927, following two years of teaching and graduate study in structural engineering, he received the degree of master of science. The degree of civil engineer was conferred on him in 1940. For a part of 1941 he was instructor in civil engineering at Rutgers, and during 1941–1942 he was lecturer in civil engineering at Princeton University. Since 1927 Mr. Gronquist has been continuously associated with the consulting engineering firm of Robinson and Steinman, of New York, successively as assistant engineer, resident engineer, and associate engineer. During this time he has been resident engineer on the Waldo-Hancock suspension bridge project at Bucksport, Me., and has had charge for Robinson and Steinman of the design and supervision of construction of the Henry Hudson arch bridge in New York; the Wabash River self-anchored suspension bridge at Hutsonville, Ill., and the Charter Oak Bridge over the Connecticut River at Hartford. The latter is the longest span continuous girder bridge in the United States. Mr. Gronquist is a member of Phi Beta Kappa and Sigma Xi, and is serving on the Society's Annual Meeting committee.

Paul Baumann, M. Am. Soc. C.E., was graduated from the Federal Institute of Technology in Zurich, Switzerland, in 1918. Before coming to this country two years later, he was engaged in military engineering on roads and fortifications, flood control work, and power developments in the Alps. His early work here consisted of the position of office and resident engineer on the design and construction of the Lake Arrowhead project in California. He was also connected with the survey, design, and exploration of the Paradise-Verde irrigation project in Arizona, and with structural design and studies on steam plants and hydroelectric developments for the Fargo Engineering Company in Jackson, Mich. From 1926 to 1934 Mr. Baumann was chief design engineer with Quinton, Code and Hill, Leeds and Barnard in Los Angeles on dams, hydraulic structures, water-front works, and harbor developments, and for the past nine years he has been assistant chief engineer of the Los Angeles County Flood Control District—in charge of dam, debris-basin, and spreading ground projects, hydraulic and hydrologic work, and testing and communications. In 1936 he was awarded the James Laurie Prize for his paper, "Analysis of Sheet-Pile Bulkheads."

Thomas A. Middlebrooks, Assoc. M. Am. Soc. C.E., was born in Yatesville, Ga., on December 13, 1903, and educated at the Georgia School of Technology, receiving the degree of B.S. in C.E. in 1928. In 1930 he did postgraduate work at Massachusetts Institute of Technology. Mr. Middlebrooks has been with the U.S. Engineer Department since 1928. He was chief of the Soil Section in the Vicksburg Engineer District during the levee-construction program, following the 1927 flood. From 1933 to 1937 he was chief of the Soils and Foundation Section for the Fort Peck Engineer District during the construction of the Fort Peck Dam. Since 1937 he has been in charge of the Soil Mechanics Section in the Office of the Chief of Engineers.

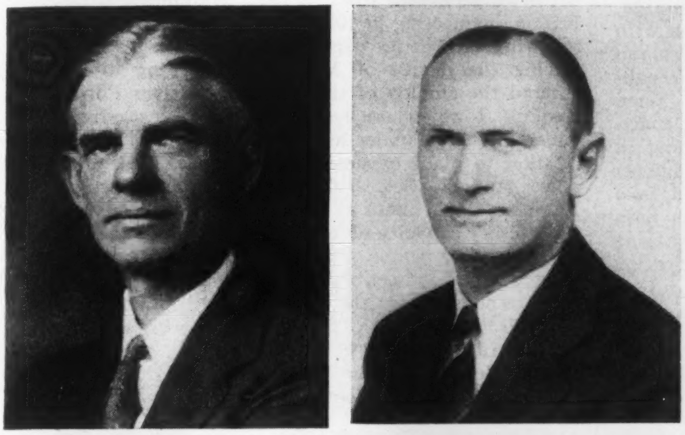
Milton Harris, Assoc. M. Am. Soc. C.E., was born at The Dalles, Ore., on January 13, 1896, and graduated from Oregon State College in 1917, with the degree of B.S. in civil engineering. Following two years of service in the U.S. Army, Major Harris became connected with the Southern Pacific Company, where he remained until 1926—for part of this period as assistant engineer on maintenance. In 1928, after two years in construction work, he became connected with the California Division of Highways, where he was successively assistant highway engineer, office engineer, assistant state safety engineer, and associate highway engineer. In 1942 he severed his connection with the Division of Highways in order to accept a commission as major in the Corps of Engineers, U.S. Army. Major Harris is the recipient of the Arthur M. Wellington Prize for his paper on "Traffic Engineering as Applied to Rural Highways." Unfortunately it was impossible to obtain his photograph.

George J. Schroepfer, Assoc. M. Am. Soc. C.E., was born in St. Paul, Minn., on September 7, 1906, and was graduated from the University of Minnesota in 1928, with the degree of B.S. in civil engineering. His first position was that of junior engineer with the

THOMAS E. STANTON
Norman Medal for Paper, "Expansion of Concrete Through Reaction Between Cement and Aggregate"

C. H. GRONQUIST
J. James R. Croes Medal for Paper, "Simplified Theory of the Self-Anchored Suspension Bridge"

T. A. MIDDLEBROOKS
James Laurie Prize for Paper, "Fort Peck Slide"



HAROLD A. THOMAS and EMIL P. SCHULEEN
Karl Emil Hilgard Prize for their Paper, "Cavitation in Outlet Conduits of High Dams"

PAUL BAUMANN
Thomas Fitch Rowland Prize for Paper, "Design and Construction of San Gabriel Dam, No. 1"

GEORGE J. SCHROEPFER
Rudolph Hering Medal for Paper, "Experiences in Operating a Chemical-Mechanical Sewage Treatment Plant"

RAY K. LINSLEY, JR., and WILLIAM C. ACKERMANN
Collingwood Prize for Juniors for their paper, "Method of Predicting the Runoff from Rainfall"

Metropolitan Drainage Commission in the investigation of the Mississippi River pollution problem, and while so employed he continued his academic efforts, receiving the M.S. degree in C.E. in 1930 and the professional degree of C.E. in 1932. By 1933 he had advanced to the position of principal assistant engineer. In the same year he became assistant chief engineer of the newly created Minneapolis-Saint Paul Sanitary District, which position he held until 1938. Since then Mr. Schroepfer has been chief engineer and superintendent in charge of the operation and maintenance of this system. In addition, he is serving as lecturer in sanitary engineering at the University of Minnesota. He has been president of the Central States Sewage Works Association, the Federation of Sewage Works Associations, and of the Northwestern Section of the Society, and is a member of Chi Epsilon, Tau Beta Pi, and Sigma Xi. He is also a member of the Executive Committee of the Sanitary Engineering Division of the Society, and chairman of the General Policy Committee of the Federation of Sewage Works Associations.

RAY K. LINSLEY, JR., Jun. Am. Soc. C.E., was born in Hartford, Conn., on January 13, 1917. He graduated from Worcester Polytechnic Institute in 1937, receiving the degree of bachelor of science in civil engineering with high distinction. Soon thereafter Mr. Linsley entered the hydraulic data division of the Tennessee Valley Authority, where he was employed on river forecasting and allied hydraulic studies. Since 1940 he has been with the U.S. Weather Bureau, successively as junior hydrologic engineer in the hydrometeorological section, Washington, D.C.; assistant hydrologic engineer for the Sacramento, Calif., river district; and (at present) as an associate hydrologic engineer assigned to problems of river forecasting in the western United States. He is the author of several papers on hydrology and a manual, "River Forecasting Methods," for the Weather Bureau. He is a member of the committee on snow of the American Geophysical Union, Lambda Chi Alpha fraternity, Tau Beta Pi, and an associate in Sigma Xi.

WILLIAM C. ACKERMANN, Jun. Am. Soc. C.E., was born in Sheboygan, Wis., on October 7, 1913. He attended Lawrence College at Appleton, Wis., and the University of Wisconsin, graduating from the latter in 1935 with the degree of B.S. in civil engineering. College honors and fraternities include Psi Chi Omega, Alpha Sigma Phi, Chi Epsilon, Tau Beta Pi, and graduation with honors. For six months following his graduation Mr. Ackermann was employed by the Kimberly-Clark Corporation of Neenah-Menasha, Wis., as field engineer on plant construction. Since December 1935 he has been in the Water Control Planning Department of the Tennessee Valley Authority in Knoxville—first in river forecasting and, at present, as associate hydraulic engineer on special water-control investigations. Mr. Ackermann is a member of the Technical Society of Knoxville. He has been active in the Tennessee Valley Section and at present is managing editor of the *Tennessee Valley Engineer*, official monthly publication of the Section.

HAROLD A. THOMAS, M. Am. Soc. C.E., was born in Ann Arbor, Mich., on July 24, 1885, and was graduated from Columbia University with the A.B. degree in 1906 and the C.E. degree in 1908. In 1909 and 1910 he was instructor in civil engineering at the University of Washington, and from 1911 to 1923 was successively associate professor and professor of civil engineering at Rose Polytechnic Institute. In 1923 he came to Carnegie Institute of Technology where he now holds the positions of professor of civil engineering and acting head of the Department of Mechanics. During the vacations and spare hours of a teaching career he has acted in various engineering and consulting capacities, including that of senior engineer in the Philadelphia office of the U.S. Engineers, in charge of survey and report on water resources of the Delaware River basin; hydraulic engineer for the city of Pittsburgh on river-wall studies; consulting engineer for the Pittsburgh Flood Commission on review of the flood protection program for upper Ohio River basin; and consulting engineer for the Westinghouse Electric and Manufacturing Company on the Turtle Creek backwater flood-control project. Mr. Thomas is the author of *The Hydraulics of Flood Movements in Rivers* and of various papers on hydraulic subjects.

EMIL P. SCHULEEN, Assoc. M. Am. Soc. C.E., was born in Sioux City, Iowa, on October 25, 1897. After a lapse of six years between his preparatory schooling and engineering training, he entered the State University of Iowa in 1922, graduating with the degree of B.S. in engineering in 1926. He remained at that institution the following year in the capacity of hydraulic research assistant, receiving the degree of M.S. in engineering in 1927. He then entered the employ of the Mississippi River Power Company at Keokuk, Iowa, where he was engaged on studies of Mississippi River discharge under ice cover, problems of structural design in relation to plant expansion and maintenance, and hydroelectric power studies. Since 1929 he has been in the service of the U.S. Engineer Department at Pittsburgh, Pa.—from 1930 to 1942 in a supervisory capacity on engineering studies and reports pertaining to navigation, water supply, pollution abatement, hydroelectric power, and flood-control projects. Since January 1942 he has been responsible for the operation and maintenance of all Pittsburgh Engineer District flood-control works, including an extensive channel improvement at Johnstown, Pa., two flood-wall developments, four flood-control reservoirs, and four reservoirs for the combined purpose of flood control and low stream-flow regulation.

Four New Honorary Members of the Society

EDWARD HANSON CONNOR

EACH TIME Edward H. Connor takes his watch out to note the time, he is reminded of the biggest job he ever tackled—the design of the plan of the construction of the piers for the East Bay section of the San Francisco–Oakland Bay Bridge. The handsome platinum encased timepiece was presented to him, "able engineer, wise counsellor, efficient director, in appreciation of his valued services as Managing Engineer." The caisson for one of these piers was sunk deeper than any other caisson in the world.

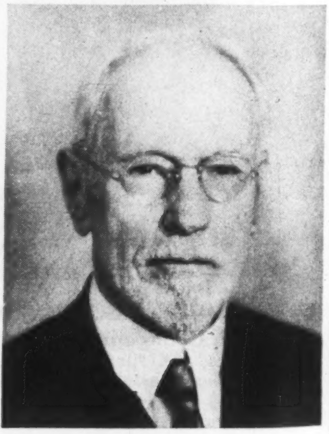
Success of this project and the countless others completed by Mr. Connor can be directly attributed to his formula for success, the ancient one of "95% perspiration and 5% inspiration." However, it must be said that his inspired moments have greatly extended his outstanding services.

It was at Alton, Ill., that Edward Connor was born in 1864. His father, who had moved to the prairies east of the Mississippi River some years before, was a manufacturer of farm machinery, and his machine shop provided a fertile field for young Edward's creative energies. After high school he attended Washington University at St. Louis and graduated from the civil engineering course in 1887.

At that period, vast fields were opening up for bridge building companies. Railroads were extending their lines through the Middle West and beyond. It was with Morison and Corthell, both noted engineers and later presidents of the Society, that Edward Connor first entered the field that was to be his life work. On this first job he was assistant engineer on the construction of a bridge for the Illinois Central Railroad across the Ohio River at Cairo, Ill.

From one bridge job to another he moved, employed at various times by Morison and Corthell, the Union Bridge Company, and the Rock Island Railroad until 1899, when he accepted the position of engineer in the fast-growing Missouri Valley Bridge and Iron Works at Leavenworth, Kans. It has been with this company that he has made bridge building history. In 1904 he was made vice-president and chief engineer of the company; he has served in this capacity and as consulting engineer ever since.

The Missouri Valley Bridge Company has constructed bridges across the Missouri River all the way from St. Charles, Mo., to Wolfe Point, Mont.; of these the bridge at Wolfe Point contained the longest span—400 ft. In addition there has been a vast amount of bridge building throughout the Middle West and West. As the company's chief engineer, Mr. Connor became a familiar figure at bid openings throughout the country. His sharp pencil in figuring bids has brought many a chill to the spines of competing bidders especially when bids were being taken for this favorite type of job—unusually deep and difficult marine foundations, with pneumatic or open dredged caissons. He is especially well known as a designer of structures of this type utilizing unique and economical methods of anchorage.



EDWARD HANSON CONNOR

In his 44 years with the bridge company, Mr. Connor has won countless friends in his profession and in his community. An excellent sense of humor and his insistence upon clearing up any and all personal difficulties—even if it requires time and detailed discussion—have appealed to his associates. In his community he has been a leader in church and fraternal organizations. He is proud of the civic duties he has assumed and which he discharges punctiliously. He was a member of the Leavenworth, Kans., board of education for 12 years. He was chairman of the Cushing Memorial Hospital Association when the new hospital was built; and is still a trustee. He was also chairman of the Water Works Board when the new water works were built, and is still chairman of that board. It is evident that when he is on hand things get done.

He is found regularly at professional society meetings with his pipe constantly at hand. Until recent years he was a frequent contender on the golf links and took great pleasure in motor trips with his family to the Lakes region or the Rockies. Perhaps his greatest enjoyment at present is watching the development of his three grandchildren.

In spite of heavy demands upon his time, he has been active in the affairs of the Society, serving as Director from 1913 to 1915 and as president of the Kansas State Section in 1931. He is also a member of the American Railway Engineers Association, the Engineers' Club of Chicago, the St. Louis Engineers' Club, and the Kansas Engineering Society.

Although in 1937 he retired as chief engineer of the company, when the war broke out he went back on full time to further the effort his company is making to provide steel ships for the U.S. Navy.

FRANCIS TRENHOLM CROWE

As a builder of dams, Frank Crowe is preeminent. From the start of his professional career this appears to have been his one ambition, and he is quoted as saying of Boulder Dam, "I was wild to build this dam."

Francis Trenholm Crowe was born in Trenholmville, Canada, on October 12, 1882. He received his higher education at the University of Maine, from which he graduated, with the degree of B.S. in C.E., in 1905. Thirty years later his alma mater conferred on him the honorary degree of Doctor of Engineering.

Francis Trenholm Crowe

Immediately upon graduation, Mr. Crowe became associated with the Bureau of Reclamation (then the U.S. Reclamation Service), where he was not long in reaching positions of responsibility and leadership. While first assistant to the superintendent of construction on Arrowrock Dam (for 20 years the world's highest dam), he designed a comprehensive concrete conveying and distributing system, as well as a then-unique pipe system for the pneumatic transportation of cement. Before terminating his connection with the Bureau, he had become gennral superintendent of construction, office of the chief engineer, Denver, Colo., and had acquired an enviable reputation for ingenious, orderly prosecution of construction work with dispatch and economy.

After 1925, as field representative for various contracting firms, Mr. Crowe directed the construction of five important dams designed and built by the Bureau of Reclamation. The first was the Guernsey Dam on the Platte River in Wyoming, and the second the Deadwood River Dam in Idaho, both for the Morrison-Knudsen Company. The latter dam was completed in the fall of 1930 in time for Mr. Crowe to take an active part in the estimate and negotiations for Boulder Dam. In 1931 he became general superintendent for the Six Companies, Inc., in charge of construction of this, the highest concrete dam ever built. Then came two structures not built for the Bureau—the Copper Basin and Gene Wash Dams for the Metropolitan Water District of Southern California.

Next came Parker, the deepest concrete dam ever built, and then Shasta, the second highest concrete dam in the world, with the highest spillway. This he is now engaged in bringing to a successful conclusion.

Much of the story of his part in the building of Boulder, Parker, and Shasta dams was told in *Fortune Magazine* for August and September 1943. The article stated that "to the extent it can be said to belong to any single man, Boulder was Frank Crowe's triumph." His interest dated back a quarter of a century to the time when as a young engineer with the Bureau of Reclamation he worked under the late A. P. Davis, then Director of Reclamation and later President of the Society. Mr. Davis fired Crowe's imagination with the vision of a dam spanning the deep and gloomy canyon.

In building this dam it was necessary not only to conquer the forces of nature but also to work harmoniously with the largest and most varied set of personalities that had ever been engaged on the construction of a single project—the members of Six Companies Inc., composed of Morrison-Knudsen, the Utah Construction Company, J. F. Shea Company, MacDonald and Kahn, the Henry J. Kaiser and W. A. Bechtel companies, and the Pacific Bridge Company. The leading members of these firms, combined in the "Six Companies, Inc.," which included Steve Bechtel, Assoc. M. Am. Soc. C.E., and Henry J. Kaiser, have become nationally famous since the completion of Boulder Dam. Crowe's job was to work with, as well as for, this notable group of men, who have been described as the prima donnas of their profession. Considering the difficulties, of which the climate was not the least, Crowe made a remarkable record in completing the dam in five years—two years and two months ahead of schedule—and with a profit of ten million dollars, or over 25% of the cost of construction.

The next major project after Boulder was the Parker Dam. The outstanding feature of this concrete arch structure is that although it raises the level of the Colorado River only about 105 ft, it has a maximum over-all height of about 320 ft; this means that two-thirds of its height is under the original river level. Mr. Crowe successfully conquered the unique problem of putting a major structure on so deep a foundation.

In 1939 he moved on to Redding, Calif., to be superintendent of the Shasta Dam, a part of the Central Valley Project which is being handled by the Bureau of Reclamation. A peculiar feature of this 550-ft structure, which raises the water level 490 ft, is the spillway in the center of the dam which will be the highest spillway ever built.

Thus Frank Crowe has realized his life-long ambition to direct heavy construction work, and in this work his record of achievement is unsurpassed. In addition he is directly responsible for a number of important developments and improvements in construction methods and equipment.

It is a source of much speculation to his friends as to what he will do after he has finished Shasta. Frank thinks he knows, and to prove it he has purchased a large ranch on Hat Creek in Shasta County. He tells everyone he plans to retire there and ride herd, fish, and hunt. But those who know him best are still unconvinced—they believe that he will start looking for bigger and better dams to conquer. He is quoted as having said, "There's something peculiarly satisfying about building a great dam. You know that what you build will stand for centuries."

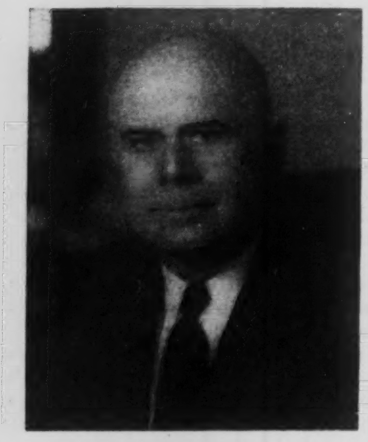
Mr. Crowe became an Associate Member of the Society in 1910, a Member in 1915, and now receives the crowning distinction of Honorary Membership.

THOMAS HARRIS MacDONALD

Since the days of the great rail-splitter, it has been counted a distinction to be born in a log cabin. But to be able to take pride in one's log cabin, it is necessary not only to have been born in it, but to have made a noteworthy success of one's life thereafter. Thomas H. MacDonald qualifies on both these counts. His log cabin was in Leadville, Colo., and the date, July 23, 1881.

When he was three, his parents moved to Iowa. In that state he grew up and was educated, receiving the degree of B.S. in C.E. from Iowa State College in 1904. His alma mater has honored him twice since, with the degree of Doctor of Engineering in 1929, and with the Marston Medal for engineering achievement in 1939.

Perhaps partly because of his pioneer surroundings, he early felt the value of good roads. His interest in them and his scientific



THOMAS HARRIS MACDONALD

and practical attitude toward them are attested by his graduating thesis—on highways. It was divided into two parts: the amount and character of use of the roads by farmers, and the tractive resistance offered by different types. One of his early pronouncements which has been widely quoted is: "We pay for highways whether we have them or not and we pay less if we have them than if we have not."

In 1904, as assistant professor of civil engineering at Iowa College, he was placed in charge of road investigation work. In 1906, at the age of 25, he was appointed highway engineer with the first highway commission in Iowa, and in 1913 became chief engineer. During his 15-year connection with the commission, he was largely instrumental in building up in Iowa what is said to be one of the best highway systems in the United States. During that period Iowa became the first state in the Middle West to establish a state-wide system of main roads, and about a third of the designated 6,400-mile network had been permanently graded, drained, and bridged. The next step—hard surfacing—was about to get under way.

It was at this time, 1919, that Mr. MacDonald was called to a wider field, to become chief of the U.S. Bureau of Public Roads. And it is as "Chief" that he is still affectionately known, although actually his title has been "Commissioner" since the "Bureau" became the Public Roads Administration.

Always a pioneer, Mr. MacDonald appeared on the national scene at the very beginning of the country's greatest period of road-building activity. Then the pieces of surfaced roads were scarcely anywhere long enough to stretch from one city to the next. Designation of the federal-aid highway system was still two years in the future, and it was to the shaping of this great master plan that the new Chief devoted his energies. This system having been established (by the Federal Highway Act of 1921), it was mainly Mr. MacDonald's insistent leadership that in the earlier years kept the country upon the charted course. It was a course that in another decade was to lead to virtual complete connection of a nation-wide system of main highways acclaimed and envied throughout the world.

But Mr. MacDonald was not satisfied. As usual his eyes were turned to the future. He perceived that the phenomenal development of the motor vehicle had already rendered many of the roads obsolete. As a guide to the needed modernization, he foresaw the necessity for a new master plan; and to lay the groundwork for that plan, he persuaded the state highway departments to inaugurate the highway planning surveys. The basic surveys are now completed. The needed modernization is overdue. But thanks to Mr. MacDonald's vision, road builders the country over have a clear appreciation of the job ahead, and detailed planning now under way will assure a prompt postwar beginning of the new and greater program.

As a young man Mr. MacDonald spent one year on a cattle ranch in the sand hills of Nebraska. He still loves the feel of the saddle and enjoys outdoor life. He particularly enjoys a picnic dinner, preferably in the woods by a small stream. Friends who have enjoyed such outings with him agree that the excellence of his cooking fully justifies the care with which he prepares the bed of coals. As one remarked, "I must confess that he can broil a steak better than anyone I have ever known." His culinary art extends to the kitchen; both plain and fancy dishes are on his list.

Among Mr. MacDonald's outstanding characteristics, aside from his professional attainments, are his patience, understanding, and deep sense of loyalty to those who work with and for him. His whole adult life is one continuous record of unselfish public service.

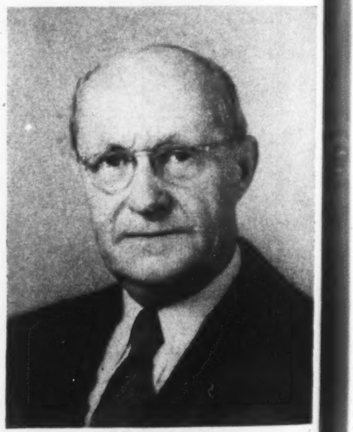
Mr. MacDonald is a member of many organizations, mostly concerned with highways. He has been active in the affairs of the Permanent International Association of Road Congresses since 1926, attending its Milan, Italy, sessions that year, serving as Secretary General of the 6th Congress, held in Washington, D.C., in 1930, and heading the official American delegation to the Congress at The Hague in 1938. He has won recognition from three foreign countries. The French government conferred on him the Cross of the Legion of Honor; the King of Norway invested him as a Knight of the First Class of the Order of St. Olav; and the Czechoslovakian Government appointed him a Foreign Member of the Masarykova Akademie Prace. In his own country, his professional confreres have now recognized his eminence in the field of civil engineering by awarding him Honorary Membership in the Society.

GERARD HENDRIK MATTHES

A BOYHOOD HOBBY provided the incentive which has made Gerard Matthes an authority on problems relating to navigation, water power, and flood control. While a lad in Switzerland, his interest in the behavior of small mountain streams and in building dams and diversion works prepared him to enter upon his chosen profession. At present he is Head Engineer of the Mississippi River Commission and Director of the U.S. Waterways Experiment Station at Vicksburg, Miss.

Like many other Hollanders, Gerard Matthes (born in Amsterdam in 1874) has had a truly cosmopolitan education. The Matthes family had connections in Belgium, and frequent visits to them necessitated his learning French at an early age. Later he—and his twin brother François—went to school for four years in Geneva and neighboring places in Switzerland, and so he learned to speak French almost as well as his mother tongue. Next he went to high school at Frankfurt-am-Main for three years, and gained a fair mastery of German. In Switzerland he had picked up some English while playing cricket and football with English and American boys. In Germany he studied the language further, and so when the family came to the United States in 1891, he knew enough English to start right in on a course in civil engineering at the Massachusetts Institute of Technology. But he still does his arithmetic in Holland Dutch.

Upon graduation from M.I.T. in 1895, he served in various capacities on water-control surveys and flood-damage investigations. During this period his services were engaged by the U.S. Geological Survey, U.S. Reclamation Service, private utilities, Pennsylvania State Water Supply Commission, and the Miami Conservancy District. Later outstanding assignments were the survey of the Tennessee River and its tributaries, where he organized the first large aerial survey undertaken by the War Department, and studies relating to the improvement of the Mississippi River by means of cutoffs and dredging.



GERARD HENDRIK MATTHES

A notable contribution to the science of stream control was his tetrahedral block revetment for river banks. He has also devised a topographic slide rule for use in plane-table surveying. During several years in private practice, he developed many useful applications of aerial surveying, which has now grown to be an essential tool in water-power and stream-control surveys.

In an advisory capacity, Mr. Matthes has served as a member of the consulting board for Conchas Dam, New Mex.; as a member of the board of flood consultants for the TVA; and as water consultant for the National Resources Committee for the lower Mississippi Valley.

One of his favorite sports is swimming, which he has sometimes put to practical use by diving into the Mississippi in order to investigate its mysterious currents and eddies. In this way he has disproved some of the prevailing misconceptions and superstitions regarding the "Father of Waters."

He has always had a keen appreciation of beauty, wherever found, and has taken deep interest in nature studies, especially in observing the habits of insects. For a number of years he found an outlet for both these enthusiasms by collecting the big cocoons of Cecropia moths in order to watch the winged creatures hatch out, often accelerating the process by the heat of an electric toaster on the Sunday morning breakfast table. Then he would mount the moth, collect lovely grasses, leaves, and thistledown, and combine all in an artistic group for use under glass on a wooden tea tray, which would then delight a friend or relative at Christmas or on a birthday.

Geological formations have at all times been of profound interest to Mr. Matthes, especially in their bearing on engineering matters. During his present connection, he has directed a study of the transportation of alluvium by streams, and its effect on the stabilization of river channels and the maintenance of levee systems. He is justly proud of the new model of the watershed of the entire Mississippi River system now being completed by his staff at the Vicksburg Station. This model, which will be used to study the complex problems now arising in the operation of the vast reservoirs for flood control, will cover the better part of a square mile of land surface.

During his association with the Society, since 1905, he has prepared many technical articles and reports dealing with studies on which he has been engaged. He has thus shared with the members of his profession his many valuable and interesting experiences. Long active in the Hydraulics Division, he became chairman of the Joint Committee on Floods in 1943. He is a member of the American Institute of Mining and Metallurgical Engineers and the Society of American Military Engineers.

He has always looked upon his life's work as a delightful adventure and has zealously made the most of every opportunity to study the natural forces that affect the waterways of the world. In this he has been singularly successful, fully meriting this new distinction of Honorary Membership in the Society.

Members Under Arms Profit by Special Society Privileges

Many younger Society members in the armed services are entitled to special consideration in the matter of dues. For those who may have missed the previous announcement, a repetition of the action of the Board of Direction at its October meeting is given as follows:

> "Cancellation of 1944 dues is hereby extended automatically to all those members of the Society in the armed services of the United States who are Selectees; and, upon request for such cancellation, to those commissioned officers receiving base pay of $2,400 or less. Those who receive this exemption will continue to be listed as members of the Society and have prior unpaid dues canceled; and those who are Corporate Members shall retain their voting rights. However, no publications except Civil Engineering are to be forwarded to those thus exempted."

Texas Section Holds Fall Meeting

This year the fall meeting of the Texas Section was streamlined to meet war conditions. Thus social activities, business matters, and technical discussions were merged into the usual "preconvention party" and a one-day meeting. Members of the Section and their lady guests met in Austin on the evening of October 28.

The meeting proper got off to a good start early the next day. Members were welcomed by Walter Seaholm, acting city manager of Austin, pinch-hitting for the mayor who was ill. The remainder of the morning was devoted to business discussion and the presentation of committee reports. The annual election of officers, held during this session, resulted in the selection of the following: E. N. Noyes, president; Willard Simpson and C. Milo Thelin, vice-presidents; and John A. Focht, secretary-treasurer. Because of the war the usual Student Chapter breakfast had been dispensed with, but Student Chapter members attending the meeting were invited to have lunch with the Section that noon. The after-luncheon program was presented by members of the University of Texas Chapter, with J. G. Dickson giving the principal talk.

Speakers at the afternoon technical session were George C. Smith, assistant to the president of the Missouri, Kansas and Texas Railway at St. Louis, Mo., who discussed the future industrial development of Texas and the Southwest; John J. Frederick, professor of transportation and industry at the University of Texas, whose subject was "Some Phases of Postwar Transportation"; and Oscar H. Koch, Dallas consultant, who spoke on planning for postwar development. At the banquet that evening Dr. Walter P. Webb, professor of history at the University of Texas, who has been at Oxford University the past year, gave a talk on conditions in England and plans for a new London.

Two Features Lost to "Civil Engineering"

It will be noted that, commencing with this issue, two old and esteemed friends that have been appearing monthly in Civil Engineering are omitted. These are the page in the front part which has always been designated as the "Page of Special Interest," and the first regular department, a sort of editorial, appearing under the caption, "Something to Think About."

Omission of these two departments creates real war losses. Their sacrifice is in effect one device for complying with the most recent War Production Board regulation with respect to paper tonnage—that is, to effect a saving of 25% from the quantity used in 1942. Of the two, the Page of Special Interest is the older, having been included in each issue since the very first. It has been considered a feature that not only added to the value of the publication but afforded interest to members. Sometimes it was stimulating esthetically, then again technically.

Although not so old, the department "Something to Think About" was a unique feature of the publication. It was established in February 1937, and has since continued without interruption. In effect it was a sort of editorial forum. It provided opportunity to ask critical questions, to stimulate interest and thought with regard to problems relating to the profession. Always provocative, at times it even went to the point of being somewhat revolutionary. It has been directly under the supervision of the Committee on Publications.

It goes without saying that the omission of these two important features from Civil Engineering is greatly regretted, even in wartime. However, it is felt that the required space can better be utilized by the technical articles, for which there is such great demand. And there is always the hope that with the relaxation of paper restrictions, these old friends can be welcomed back again to our pages.

Such possibility provides still another reason for looking forward to that better day when the interests of peace may again be the compelling factors in engineering life—and in publication practice.

Election of Officers for E.C.P.D.

At the eleventh annual meeting of the Engineers' Council for Professional Development, held recently in New York City, Everett S. Lee, engineer for the General Engineering Laboratory, General Electric Company, Schenectady, N. Y., was elected chairman for the coming year. Elected to serve with him are James W. Parker, vice-president and chief engineer, Detroit Edison Company, vice-chairman; Stephen L. Tyler, executive secretary, American Institute of Chemical Engineers, secretary; and R. L. Sackett, dean emeritus of engineering, the Pennsylvania State College, assistant secretary. Dean Sackett is a member of the Society.

Engineers' Council for Professional Development includes the following national organizations: American Society of Civil Engineers; American Institute of Mining and Metallurgical Engineers; American Society of Mechanical Engineers; American Institute of Electrical Engineers; the Engineering Institute of Canada; American Institute of Chemical Engineers; Society for the Promotion of Engineering Education; and the National Council of State Boards of Engineering Examiners.

Objectives of the Council are to coordinate and promote efforts to attain higher professional standards of education and practice, greater solidarity of the engineering profession, and greater effectiveness in dealing with technical, economic, and social problems. Headquarters are maintained in the Engineering Societies Building, 29 West 39th Street, New York 18, N.Y.

Life Memberships Awarded

AGAIN we announce the list of men who become Life Members of the Society at the beginning of the new year, that is, on January 1, 1944. In accordance with the Constitution, either these men are 70 years old and have paid dues as Corporate Members for 25 years, or if they are under 70, they have paid dues for 35 years. After these periods of faithful membership, they become exempt from the further payment of dues, while still remaining members and enjoying the privileges which this implies. The list follows:

MEMBERS EXEMPT JANUARY 1, 1944

Ackerman, Alex. S.
Armstrong, Roger W.
Arn, William G.
Badenhausen, John P.
Baillie, Frank S.
Baldwin, Wm. J., Jr.
Berry, Francis R.
Berry, Herman C.
Black, Gurdon G.
Black, Ralph P.
Blair, McCrea P.
Blamphin, Arthur M. N.
Blatt, Max
Blood, Charles F.
Blum, Louis P.
Boggs, Frank C.
Boltz, Thomas F.
Bouillon, Arthur M.
Boyd, Butler, B.
Brower, Irving C.
Brown, Burtis S.
Brown, Charles B.
Brown, Collingwood B.
Brown, Earl I.
Brown, William N.
Bull, George M.
Burrell, Glenn S.
Burton, William
Campbell, Henry A.
Carey, Edward G.
Carhart, Frank M.
Carrick, Robert E.
Carstarphen, F. C.
Chew, Richard S.
Christie, Hans L.
Cilley, Morgan
Claybaugh, Harry W.
Clinton, Samuel D.
Codwise, Henry R.
Cohen, Isidore
Collier, William N.
Collins, Frank J.
Conard, Clarence K.
Conley, Clyde G.
Conner, Ralph M.
Conover, Charles E.
Copland, Alex. C.
Coroalles, Manuel A.
Crosby, Hewitt
Damon, Albert F., Jr.
Dent, Walter D.
Dicke, Edward C.
Dickerson, Oliver H.
Diehl, George C.
Durham, Henry W.
Edelen, Thomas J. S.
Edwards, Llewellyn N.
Elliott, Malcolm
Emig, John W.
Etcheverry, B. A.
Fairbairn, Jn. M. R.
Federlein, Walter G.
Ferguson, John B.
Fineren, William W.
Fisher, Walter A.
Fisher, Wilbur H.
Forrest, Charles N.
Fortney, Camden P.
Fouilhoux, Jacques A.
Fox, Ernest F.
French, Halsey
Fries, Amos A.
Gearhart, Orval L.
Gillen, Walter J.
Girand, James B.
Goodman, Louis
Gram, Lewis M.
Grant, Kenneth C.
Grant, Ulysses S. 3d
Gray, Henry L.
Griswold, Lee S.
Hamill, Alexander S.
Hammond, Charles L.
Hand, George T.
Heck, Nicholas H.
Hennebique, Jules J.
Hershey, Joseph W.
Hicks, John R.
Hill, George S.
Hilton, Harry LeG.
Holland, Leon L.
Holley, Harry H.
Huff, Clyde L.
Hurd, Charles H.
Johnson, Maro
Johnston, Charles E.
Jones, Samuel R.
Jordan, Harry E.
Judd, Frank R.
Kastenhuber, Edwin G., Jr.
Kemmler, Edward A.
Kimball, Joseph H.
Kinsey, Edmund R.
Knight, Richard W.
Krellwitz, Diedrich W.
Lambert, Byron J.
Laurgaard, Olaf
Lawrence, Edgar H.
Lindholm, Carl B.
Longley, Francis F.
Macartney, Morton
MacNaughton, Ernest B.
McCormick, Ralph S.
McGrew, John A.
Mahoney, Joseph N.
Mansfield , Newton
Merrill, Oscar C.
Miller, Hiram
Mitcham, George N.
Moorehead, Theodore P.
Morrison, Thomas J.
Morrow, Frederick E.
Muckelston, Hugh B.
Murphy, John J.
Musson, Charles A. W.
Nash, Franklyn D.
Nelson, Fred B.
Norcorss, Theodore W.
O'Neill, Owen H.
Paddock, Howard C.
Paige, Jason
Patterson, Clair B.
Perkins, Frank E.
Perrot, Emile G.
Perry, Francis W.
Phillips, Silas B.
Plogsted, Walter J.
Pond, Henry O.
Price, Charles P.
Reeves, Carl H.
Richardson, Rex D.
Riggs, Thomas
Rowland, Otis F.
Rush, Henri
Rust, Henry P.
Sanford, Walter E.
Sargent, Paul D.
Schubert, Charles W.
Schulz, Edward H.
Shikles, James W.
Smith, Forrest L.
Smith, Thomas A.
Sonderegger, Arthur L.
Splitstone, Charles H.
Sterling, Paul
Stevens, Harold L.
Stevens, Howard E.
Stocking, Jerome B.
Sturgeon, George B., Sr.
Sweetser, Charles H.
Tarr, Simon W.
Taylor, Granville L.
Tilt, Garret E.
Van Norden, Rudolph W.
Vent, Frederick G.
Watkins, Guy A.
Weiland, Adelbert A.
Welborn, Marvin C.
Whiting, Geo. Wm. C.
Wickersham, John H.
Wiggins, Ralph R.
Williams, Jacob P. J.
Windsor, Philip B.
Witmer, Francis P.
Wooldridge, Charles L.
Wright, Parker O.
Wyman, Alfred M.
Young, Lewis M.

Leon S. Moisseiff Memorial Planned

ASSOCIATES of the late Leon S. Moisseiff, M. Am. Soc. C.E., are forming a memorial committee to perpetuate his personal and professional ideals. Moisseiff was known as an indefatigable committee member in technical societies, including the American Society of Civil Engineers, American Welding Society, American Society for Testing Materials, American Institute of Steel Construction, and other groups. He was the first to apply the deflection theory in the design of suspension bridges in this country, having applied it in the design of the Manhattan Bridge.

The memorial suggested would consist of a bronze plaque at the Manhattan approach to that bridge, and the naming of this approach "Moisseiff Plaza." In addition, annual symposia on topics in which Moisseiff was interested are contemplated. Friends who wish to serve on the committee may address their inquires to The Leon S. Moisseiff Memorial Committee, 393 Central Park West, Box 402, New York 25, N.Y.

Recalling Society's European Trip, 1889

AN UNUSUAL item appears in the Society record book of attendance at the Reading Room, under date of October 23. The note and the signatures read as follows: "Only Survivors of American Society of Civil Engineers Trip to Paris Exhibition, 1889:

James B. French
Andrew J. Provost, Jr.
T. Kennard Thomson
A. Prescott Folwell"

It is significant that these four are the only ones that remain of several dozen who accepted the Society's invitation to join in a European trip in 1889. Some were not members at that time—one, at least, was too young. It is also a coincidence that all four reside in the metropolitan area, including New Jersey and Connecticut, that all are hale and hearty, and that their memories would put to shame many a younger member.

They gathered for one primary reason, to discuss their recollections of this famous Society voyage, for putting in the official archives. It will be recalled that a year ago, on the occasion of the Society's 90th anniversary, a number of interesting historical notes were collected in the November issue of CIVIL ENGINEERING. At that time, a request was broadcast for further details and anecdotes dealing with historic events in Society history. The present effort is one of the results and it is hoped that it may be productive of one or more interesting accounts for publication.

These four members comprise two pairs of comrades, whose friendship has been continuous for more than fifty years. Messrs. French and Thomson were associated in the design office of the old Penncoyd Iron Works, while Messrs. Folwell and Provost were companions on the celebrated European trip, held joint letters of credit, and shared in a number of interesting experiences both during the meetings and on the trips that followed.

The interest of these four members of the Society in putting their valuable recollections on record should be an inspiration to others. For example, who can act as historian for the celebrated Society convention held in London, England, in 1900? Or for the similarly notable convention in Mexico City in 1907? Personal records on these two events are practically non-existent as far as the Society's files are concerned.

Mechanical Engineer Wins Alfred Noble Prize

THIS year the Alfred Noble Prize has been awarded to Benjamin J. Lazan for his paper, "Some Mechanical Properties of Plastics and Metals Under Sustained Vibrations," which was published in the February 1943 *Transactions* of the American Society of Mechanical Engineers. The presentation took place at the annual dinner of the society, of which Mr. Lazan is a member.

Mr. Lazan was born in New York on April 20, 1917, and graduated from Rutgers University in 1938. Following a year of graduate work at Harvard University, he was an instructor in the department of engineering mechanics at Pennsylvania State College for the next three years. In November 1942 Mr. Lazan joined the Sonntag Scientific Corporation as research engineer in fatigue and vibration testing machines for materials. He was promoted to chief engineer in February 1943, and became vice-president in October.

The Alfred Noble Prize was established in 1929 through a fund contributed by engineering and other friends of Alfred Noble, one-time President of the American Society of Civil Engineers. The prize is awarded annually to a young member of one of the Four Founder Societies or the Western Society of Engineers for a published technical paper of exceptional merit.

Carlton B. Jansen Wins Construction Engineering Prize

Announcement has already been made of the award of the Construction Engineering Prize to Carlton B. Jansen, M. Am. Soc. C.E., for his article, "Submerged Shipways with Steel Sheeting Walls—Constructing the Shipways," which appeared in the July issue of Civil Engineering. Presentation of this prize, which was established in 1939 by A. P. Greensfelder, M. Am. Soc. C.E., will take place at the time of the Annual Meeting in January. The Construction Engineering Prize is the only award specifically limited to material appearing in Civil Engineering.

Carlton B. Jansen

Born in New York on May 31, 1900, Mr. Jansen graduated from Union College in 1922, with the degree of B.S. in C.E. Immediately thereafter, he entered the employ of the Dravo Contracting Company (now the Dravo Corporation), of Pittsburgh, Pa., on heavy construction and deep foundation work—as field engineer and field superintendent, successively. In 1933 he was loaned to Bridge Builders, Inc., as general superintendent on the construction of foundations for the East Bay section of the San Francisco—Oakland Bay Bridge, which included piers sunk to a world-record depth. On completion of that work he returned to the Dravo Corporation in charge of all field construction of the general construction department, of which he is now manager.

Building Standard on Structural Steel

The American Standards Association has added another building standard, Structural Steel (Riveted, Bolted or Welded Construction) (A57.1-1943), to its group of building code requirements. The requirements presented in this new standard are intended to govern the design, fabrication, and erection of structural steel for buildings and other structures covered by building code requirements.

This standard, which was developed under the leadership of the American Institute of Steel Construction and the American Society of Civil Engineers, is one of a series of building standards being worked on by technical committees operating under the supervision of the American Standards Association's Building Code Correlating Committee.

The standard sells for 40 cents and may be obtained from the American Standards Association, 29 West 39th Street, New York 18, N.Y.

Protective Construction for Civilian Defense

Technical men of many professions have initiated and are organizing nation-wide technical committees through which they are contributing largely to civilian defense. As new developments are accomplished, the information is disseminated to technical organizations so that their members may be kept posted on changing defense techniques. The purpose is to educate specialists in the various fields, who will be prepared to act on the spur of the moment if, when, and where needed in civilian defense.

For the use of such specialists, a long list of published material has been made available through the Office of Civilian Defense. Those interested will be furnished on request with a list of the publications relating to their field, and will be kept informed as old material becomes obsolete or new material is issued.

Members of the Society who are interested in this important work may request a list of available material, OCD publication 4506 Requests should be made through Horace W. Peaslee, Secretary, Technical Board, Office of Civilian Defense, in Washington, D.C. Ernest P. Goodrich, M. Am. Soc. C.E., is chairman of the Committee on Protective Construction, Office of Civilian Defense.

News of Local Sections

Scheduled Meetings

Cleveland Section—Dinner meeting on January 14 (place and time to be decided later).

Dayton Section—Luncheon meeting at the Engineers' Club on January 17, at 12:15 p.m.

Georgia Section—Luncheon meeting at Davison's Tea Room, Atlanta, on January 7, at 12:30 p.m.

Kentucky Section—Smoker and inspection trip of the Junior Forum at the Seagram Distillery Clubroom on January 10, at 8:30 p.m.

Los Angeles Section—Dinner meeting at the University Club on January 12, at 6:45 p.m.

Metropolitan Section—Technical meeting in the Engineering Societies Building on January 12, at 8 p.m.

Miami Section—Dinner meeting at the Royal Center on January 6, at 7 p.m.

Northeastern Section—Annual dinner meeting at the Engineers' Club on January 24, at 6 p.m.

Northwestern Section—Dinner meeting at the Minnesota Union on January 3, at 6:30 p.m.

Philadelphia Section—Joint meeting with the Engineers' Club of Trenton at the Stacy-Trent Hotel, Trenton, N.J., on January 13, at 8 p.m. (Preceded by dinner at 6:30 p.m.)

Rochester Section—Dinner meeting at the University Club on January 6, at 6:30 p.m.

Sacramento Section—Regular luncheon meetings at the Elks Club every Tuesday at 12 m.

South Carolina Section—Winter meeting at Columbia on January 12, at 11:30 a.m. (Joint meeting with the South Carolina Society of Engineers.)

Tennessee Valley Section—Dinner meeting of the Chattanooga Sub-Section at the Ross Hotel on January 11, at 6 p.m.; dinner meeting of the Knoxville Sub-Section at the S. and W. Cafeteria on January 11, at 5:45 p.m.

Texas Section—Luncheon meeting of the Dallas Branch at the Y.M.C.A. Club on January 3, at 12:15 p.m.; luncheon meeting of the Fort Worth Branch at the Blackstone Hotel on January 10, at 12 m.

Tri-City Section—Dinner meeting at the Fort Armstrong Hotel on January 14, at 6:30 p.m.

Recent Activities

Cincinnati Section

"Developments in Concrete Research" was the topic of discussion at the October meeting of the Section, the speaker being Bartlett G. Long. Mr. Long, who is director of the Cincinnati Testing Laboratory for the Ohio River Division of the U.S. Engineer Office, described the newest apparatus being used in testing concrete both in the laboratory and in the field. His talk was illustrated with slides.

CLEVELAND SECTION

On November 12 members of the Cleveland Section heard Whiting Williams speak on "Workers' Wants—War and Postwar." Mr. Williams resigned as vice-president of a Cleveland steel plant to go to work as a laborer in a Pittsburgh steel mill, in order to get first-hand information on how the workman feels about his job. As a personnel official, in his contacts with the employees, all he could get from the workmen were their ideas about how their jobs should be handled. As a workman himself, however, he could discover what they really thought about their jobs and their employer.

CONNECTICUT SECTION

The guest of honor and speaker at the September meeting of the Section was Charles B. Breed, Director of the Society and head of the department of civil and sanitary engineering at Massachusetts Institute of Technology. Speaking on the subject of the effect of air transportation on other means of conveyance, Professor Breed drew attention to the startling change in the number of commercial transport planes now in use in comparison with the 300 planes in use before the war.

DAYTON SECTION

At the November 15 meeting of the Section H. S. Knight showed moving pictures of the installation of concrete water-pipe lines in Michigan and Virginia. Mr. Knight is connected with Price Brothers Company.

DISTRICT OF COLUMBIA SECTION

At the annual meeting of the Section, which took place on November 23, the following officers were elected for the coming year: Roy W. Crum, president; Benjamin E. Jones, vice-president; Frank L. Weaver, secretary; and Charles J. Stevens, treasurer. The list of guests included George T. Seabury, Secretary of the Society, who presented certificates of life membership to fifteen members of the Section. Mr. Seabury also discussed matters of interest to the Society.

GEORGIA SECTION

A talk on Burma, China, and India comprised the technical program at the November luncheon meeting of the Section. This was given by Capt. Lawrence B. Hall, of the U.S. Public Health Service, who spent more than a year in the region where the Chinese were building the Burma-China railroad to supplement the Burma Road. The appalling hardships of life in the region were very graphically described by Captain Hall. The Section announces that its new officers will be James C. Prather, president; M. T. Thomson and H. J. Friedman, vice-presidents; and Joseph M. Wolfe, secretary-treasurer.

IOWA SECTION

The Iowa Section held two meetings in November. The first of these took place at Des Moines on the 18th, and consisted of afternoon and evening sessions. At the afternoon business meeting the following new officers were elected for the coming year: L. C. Crawford, president; Frank Kerekes, vice-president; and L. O. Stewart, secretary-treasurer. Entertainment at the evening session consisted of an illustrated lecture on the Alaska Highway, given by Claud Coykendall, field engineer for C. F. Lytle and the Green Construction Company, of Seattle, Wash. Later in the month there was a joint session at Ames with the Iowa State College Student Chapter. The principal talk was presented by Prof. Wilbur Nelson, head of the aeronautical engineering department at Iowa State College, who discussed the subject, "Postwar Air Transportation." T. R. Agg, Vice-President of the Society and dean of engineering at the college, concluded the meeting with a brief talk on Society affairs.

KENTUCKY SECTION

A Junior Forum of the Kentucky Section was inaugurated on November 12 with a dinner, at which the Juniors were guests of the Section. Juniors were in charge of arrangements for the dinner and program, and several of them spoke briefly on the advantages to be gained by having a Junior group, and on the aims and goals of the Forum. It was decided that the Forum shall be governed by a three-man rotating committee of Juniors, one member to be replaced after each meeting. At the close of discussion E. N. Gene Diefenbach, through the cooperation of the Louisville Committee on War Information, presented "The Ramparts We Watch," a sound film on Westinghouse war products.

METROPOLITAN SECTION

The salvaging of the *Normandie* was discussed at the November meeting of the Section before a capacity audience. The principal speaker on the program was A. C. W. Siecke, consulting engineer for the New York firm of Merritt-Chapman and Scott, who outlined the technical problems involved in the salvaging of the great ship, which caught fire and capsized at her dock in the North River in New York on February 9, 1942. Mr. Siecke's paper was illustrated with lantern slides.

MICHIGAN SECTION

At the first meeting of the Section, which took place in Detroit on October 29, the following new officers were elected for the coming year: J. H. Cissel, president; C. C. Johnston, first vice-president; G. W. McCordic, second vice-president; and T. C. Hanson, secretary-treasurer. The speaker of the evening was Talbert Abrams, president of the Abrams Aerial Survey Corporation, of Lansing, who discussed the development of aerial surveying and the role of aerial photography during the war.

MID-MISSOURI SECTION

An all-day joint meeting with the Missouri Society of Professional Engineers was held in Jefferson City on October 30. Speakers at the morning session were Col. R. E. M. Des Islets, of the U.S. Engineer Office, whose subject was the Missouri River flood-control plan; Prof. Harry Rubey, director of the War Training Program at the University of Missouri, who discussed that program; and E. C. L. Wagner, secretary of the Citizens' Postwar Construction Council, who outlined the work of his organization. In the afternoon Howard F. Peckworth, assistant to the Secretary of the Society, discussed collective bargaining in its relation to the professional engineer. A dinner dance in the evening concluded the meeting. New officers for the Section are Ernest W. Carlton, president; Wayne S. Frame, first vice-president; C. P. Owens, second vice-president; W. J. Schulten, secretary-treasurer; and Manford B. Tate, Junior director.

MID-SOUTH SECTION

The regular fall meeting of the Mid-South Section was held in Memphis, Tenn., on November 15. After the group had been welcomed by the Hon. Walter C. Chandler, mayor of the city of Memphis, Lt. Col. Garner W. Miller, district engineer for the U.S. Engineer Office at Memphis, spoke. Colonel Miller's subject was "Composite Barges and Other Construction in the Memphis Engineer District." He was followed by Brig. Gen. W. A. Danielson, commanding general of the Memphis Army Depot, who discussed his experiences in organizing for efficient construction in Panama, where personnel, materials, and equipment are far from the source of supply. The group then adjourned for luncheon with the Memphis Engineers Club, at which Society Director Dickinson presented a certificate of life membership to Guy A. Watkins, of Little Rock. The principal speaker at this joint session was Joseph A. Fowler, president of the National Association of Housing Officials, whose subject was postwar housing. Speakers at the afternoon technical session were A. E. Cummings, research engineer for the Raymond Concrete Pile Company, and Eugene Bespalow, chief engineer for the Choctaw Culvert and Machinery Company. The former spoke on concrete pile foundations, while Mr. Bespalow's paper was entitled "Research on Load-Supporting Capacity of Pipes in Trenches." Later in the afternoon the following new officers were elected: Vernon H. Smith, president; John L. Saunders, vice-president; and Richard Shepherd, secretary-treasurer.

MOHAWK-HUDSON SECTION

A meeting of the Mohawk-Hudson Section of the Society was held in Albany, N.Y., on November 12. The speaker of the evening was Charles Sells, New York state superintendent of public works, who gave an interesting and informative talk on his experiences doing construction work in Iran. Among the topics touched on in his talk were the peculiar foundation conditions, the custom of designing bridges to fit the available scrap metal, the flash floods encountered on the plains, and experiences with native coolie labor.

Nebraska Section

Fall activities of the Nebraska Section include the annual joint meeting with the Student Chapter at the University of Nebraska, which was held in September, and a luncheon meeting in October. At the first of these sessions Arthur T. Lobdell, lieutenant colonel, Corps of Engineers, U.S. Army, spoke on the construction of the Alaska Highway, while the guest of honor and speaker at the second gathering was J. C. Stevens, Portland (Ore.) consultant.

New Mexico Section

"The Engineer in Civil Service" was ably discussed by M. R. Hangar at the November meeting of the Section, which was held in Albuquerque. Mr. Hangar is chief of employee relations in the district office of the Corps of Engineers. At the close of the technical session the group adjourned to the testing laboratory at the University of New Mexico, where the Student Chapter served refreshments of pie and coffee.

Northwestern Section

At the annual meeting of the Section, which was held at the University of Minnesota on December 6, new officers were elected as follows: Paul R. Speer, president; Fred T. Paul, first vice-president; W. B. Irwin, second vice-president; and F. S. Altman, secretary-treasurer. Another feature of the occasion was the presentation of certificates of life membership to O. H. Dickerson and H. E. Stevens. A talk by V. S. Peterson, agricultural consultant for E. I. du Pont de Nemours and Company, Inc., concluded the program. Mr. Peterson's subject was new inventions for everyday living.

Oregon Section

The speaker at the October meeting of the Northwestern Section was C. Boucher, who discussed the use of X-ray in the examination of castings and pipe lines. At the November meeting R. C. Rutledge gave an illustrated talk on the development of structural design by the Boeing Aircraft Company and methods of fabricating and assembling military aircraft at the plant. Mr. Rutledge is assistant project engineer for the Boeing Company. Later in the evening Society Director John W. Cunningham discussed matters of interest to the Section.

Philadelphia Section

The Philadelphia Section had two meetings in November. At the regular monthly meeting, which was held on the 9th, Scott B. Lilly, Director of the Society, gave a brief résumé of activities at the Fall Meeting of the Society. The technical program consisted of a symposium on the exploration of soil conditions and the design of foundations. Those taking part were Gregory P. Tschebotarioff, assistant professor of civil engineering at Princeton University; Frank N. Kneas, local consultant; Dale T. Harroun, associate structural engineer at the Naval Operating Base at Norfolk, Va.; Samuel T. Carpenter, assistant professor of civil engineering at Swarthmore College; and Viggo Hansen, of the Philadelphia Electric Company. At the special meeting, which took place on the 30th, Howard F. Peckworth, assistant to the Secretary, discussed collective bargaining.

Rochester Section

November was an active month for the Rochester Section, as there were three joint luncheon meetings with the Rochester Engineering Society. Speakers at these three gatherings were Henry L. Howe, city engineer; W. Earl Weller, director of the Rochester Bureau of Municipal Research; and George W. Moore, district sanitary engineer for the New York State Department of Health. On December 9 there was a joint evening meeting with local groups of the other Founder Societies and the Rochester Engineering Society. A motion picture, entitled "Oil for War," was presented through the courtesy of the Barrett Division of the Allied Chemical and Dye Corporation.

Seattle Section

Talks on the use of forest products comprised the technical program at the October 25 meeting of the Section. First, Chester J. Hogue, who is in charge of the technical service for the West Coast Lumbermen's Association, discussed the changing trends in the use of such products. Then Prof. B. L. Grondal showed charts demonstrating the results of tests of loads on laminated floors, conducted at the University of Washington. The concluding speaker was Prof. A. L. Miller, who presented a mathematical discussion of the problem of lateral distribution of concentrated loads on laminated slabs and longitudinal stringers.

Tacoma Section

"The Demand of the Technical Age on Education" was the subject of discussion at the November 16 meeting of the Section. The principal talk on this topic—presented by F. K. Kirsten, professor of aeronautical engineering at the University of Washington—proved so provocative that discussion lasted until almost midnight.

Toledo Section

On November 9 members of the Toledo Section heard Joseph F. Rawlinson discuss the subject of shipbuilding during wartime and the difficulties to be overcome. Mr. Rawlinson is superintendent of the Toledo Shipbuilding Company. Two films depicting the building of a pontoon bridge by Army Engineers, shown through the courtesy of Capt. S. R. Hickerson, concluded the program.

Tri-City Section

At the annual meeting of the Section, which was held at Rock Island, Ill., on November 12, M. C. Lorenz was elected president for the coming year. Other new officers will be F. W. Ashton, vice-president, and E. R. Adland, secretary-treasurer. The first speaker was A. N. Carter, of the editorial staff of *Engineering News-Record*, who gave an illustrated talk on the Pan-American Highway. He was followed by Col. W. N. Carey, Director of the Society and chief engineer for the Federal Works Agency, who stressed the need of a construction plan for postwar days.

Wyoming Section

A joint meeting of the Section and the Cheyenne Engineers' Club took place on November 2. Following dinner, the group heard A. W. Morgan, of the U.S. Geological Survey, discuss the ground-water survey that the federal government has been conducting in Laramie County, Wyoming.

Appointments of Society Representatives

James Kip Finch, M. Am. Soc. C.E., represented the Society in connection with the award of the Alfred Noble Prize to Benjamin J. Lazan at the annual banquet of the American Society of Mechanical Engineers, which was held in New York on December 1.

Rudolph P. Miller, M. Am. Soc. C.E., has been appointed to represent the Society on the Standards Council of the American Standards Association, succeeding E. L. Macdonald, whose term has expired. Maurice N. Quade, M. Am. Soc. C.E., will serve as alternate Society representative on the Council.

Malcolm Pirnie, M. Am. Soc. C.E., will represent the Society at the opening session of the annual meeting of the American Society of Heating and Ventilating Engineers, to be held in New York, January 31 to February 2, 1944.

Ole Singstad, M. Am. Soc. C.E., will serve as the Society's representative on the Board of Directors of the American Standards Association for the three-year term beginning January 1, 1944.

ITEMS OF INTEREST

About Engineers and Engineering

Canadian and American Unions Affiliate

THE FOLLOWING was issued for immediate release, as of December 14, by the Federation of Architects, Engineers, Chemists and Technicians, CIO.

"The Federation of Architects, Engineers, Chemists and Technicians today announced the affiliation to it of the Association of Technical Employees, the only Canadian national union of technical and professional employees.

"The Association of Technical Employees, which has branches in Montreal, Toronto, Hamilton, Windsor, and other areas, will be established as an autonomous Canadian division of FAECT.

"In making public this new affiliation to FAECT, its president, Lewis Alan Berne, stated: 'The affiliation of the national union of technical employees in Canada to FAECT and CIO is symptomatic of the thinking of technical employees in our nation as well. We welcome our Canadian neighbors and look forward to our march together toward progress and the scientific utilization of technical personnel.

" 'Technical employees play a most essential part in the war effort and their prime concern is the proper utilization of their talents and skills. This is important in the war period and for the postwar period, for planning for peace is contingent upon our ability to plan for victory. The affiliation of the Association of Technical Employees represents the growing understanding for cooperation among all technical groups, unions and societies. This kind of cooperation is growing and is a reflection of the desires of engineers, architects, chemists, and technicians for concerted activities in the interests of their economic security and their technical and professional aspirations.' "

Wage Policy Adopted by Seventh National Convention of FAECT-CIO

THE FOLLOWING communication, according to a release dated December 20, was sent to the Office of War Mobilization and the Office of Economic Stabilization:

"The plight of some 16,000,000 white-collar employees in the war period has been dramatized in the past months and quite naturally has become a matter of crucial importance in the affairs of the nation. Both labor and millions of white-collar employees and consumers have voiced their mounting regard for the hardships imposed by rising living costs.

"The Federation of Architects, Engineers, Chemists and Technicians is concerned with and active in the organization of an economic program for all technical employees. Paramount at all times is the concept of maximum production, and our considerations are based on the need for the maximum utilization of our technical personnel for the most effective prosecution of the war.

"Our interest in the economic security of technical and professional employees within and without our organization is not new. Special emphasis has been attached to this matter in the war period in relation to wartime factors.

"The concept of maximum war production requires specific responsibilities for our organization since we are so vitally concerned with the problems of planning and science. The importance of technical and scientific employees to the nation increases with progress in industrial activity and in human well-being and knowledge, for technical and scientific employees contribute vastly to the national life.

"Utilization of our technical resources and personnel to proper advantage is not only indispensable for full production for war, but also for rapid and efficient conversion to the next great national need—production for peace.

"We must note the fact that in the war period the inequities in salary rates, which date back to depression days, have been accepted by the National War Labor Board and frozen as prevailing rates. For years it has been a practice to compensate technical employees on an individual basis, and not with regard for the principle of equal pay for equal work in the same classification.

"In terms of basic earnings some improvements have been secured, but largely as a result of the efforts of organized labor.

"Our organization has approached the National War Labor Board for a comprehensive review of the inequities now prevailing, and we have worked vigorously for an effective system of uniform classifications to establish method and equitable practices in a now disordered field. In this connection, we have requested the Department of Labor to survey the nation's technical personnel.

"Specifically, we asked that the number of such employees in various industries be determined together with a listing of their skills, duties, education, earnings, experience, duration of employment, etc. Obviously, such an inventory of our technical skills is essential for a solution to the salary problem and for the proper utilization of our technical personnel in war and for postwar planning.

"Accordingly, the Federation of Architects, Engineers, Chemists and Technicians calls upon the Office of War Mobilization and the Office of Economic Stabilization to execute the following salary policy to meet the needs of the nation's technical and professional employees:

"1. Establishment of a nation-wide stabilization program for technical employees. This stabilization program should provide for (*a*) a uniform classification system as a basis for determining salary scales and to bring order out of chaos. Archaic classifications systems, such as those in Federal Civil Service, should be revised in keeping with the need for a nation-wide stabilization program; (*b*) guaranteed annual salaries; (*c*) compulsory compensation for all overtime at the rate of not less than time and a half; (*d*) dismissal pay; (*e*) patent protection and remuneration for contributions to technology.

"2. Establishment of a stabilization committee to execute the stabilization program. This committee shall have representatives of FAECT and the technical societies, industry and government.

"The FAECT recognizes that the effectiveness of this stabilization program is contingent upon the effective operation of the President's Seven Point program of economic stabilization."

N. G. Neare's Column

Conducted by

R. ROBINSON ROWE, M. AM. SOC. C.E.

AS USUAL, the January meeting of our Engineers Club was a jovial affair. The annual election attracted many—to vote the Committee's ticket after pleasantly protesting the "railroad system of underground lines." But the great attraction was the opportunity for exchanging stereotyped but sincere "Happy New Years" with old friends.

Just as oft-told fiction gains credence with the telling, so did the exchange of greetings ad infinitum engender assurance of a bounteous 1944. Radiant faces broadcast the illusion that the Japs were prospectively confined to Honshu and Tulelake. Even the cautious S. T. Mayter set 4-4-'44 for the capitulation of the paperhanger.

"Mayter is a numerologist," explained Professor Neare, "and numerologists are inventing lots of good omens for the Big

Four in '44. For example, the number of integral factors of 1944 is factorial four and factorial four is one of those factors. Further, the number 1944 can be expressed by four fours connected by algebraic operators.

"There's a good exercise for the Club. And, if you like that sort of thing, try also to express 1944 with four threes, then with four fives and, finally, with just three nines.

"Now for our unfinished business, the episode of the groove—to find the volume common to two cylinders if the axis of the smaller was a skew tangent to the surface of the larger. I'll bet, from the papers he's fondling, that Claude has the answer."

"Well, Professor Noah, I have and I haven't. The problem data leads easily to the definite integral,

$$V = 4 \csc 30^\circ \sum_1^3 \sqrt{[9 - x^2][4 - (x - 3)^2]}dx$$

which should reduce to elliptic functions. I haven't succeeded, nor have I given up. However, using Simpson's rule, I computed a volume of 46.05 cu ft, which is near enuf for pay quantities."

"I ran into the same snag," added Jim, "but I found a series solution. Substituting $x = 3 - y$, the volume becomes.

$$V = 8 \sum_0^2 \sqrt{(4 - y^2)(6y - y^2)}dy$$

Then, if $\sqrt{4 - y^2}$ is expanded by the binomial theorem, there will result a series of integrable functions, leading to,

$$V = 2 \sum_{n=0}^{\infty} \frac{0.375^{2n}(4n + 1)!}{(1 - 2n)\,(n!)^2(2n + 2)!} \left(9 \text{ vers } \frac{2}{3} - 2\sqrt{2} - 16\sqrt{2} \sum_{n=1}^{n} \frac{(2n)!(2n + 1)!}{(1.5)^{2n}(4n + 1)!}\right)$$

This does not converge very rapidly, so my answer of 47.57 cu ft may not be very precise."

"I'll accept both methods and answers," said the Professor, "tho I had hoped someone would have a solution in elliptic functions, such as,

$$V = \frac{4}{3}\sqrt{6}(70E - 14K - 15\Pi) = 48.231771 \text{ cu ft},$$

where K, E and Π are complete integrals of the first, second and third kinds to the modulus $k = \sqrt{2/3}$ and parameter (of Π of $n = -1/2$."

"Sounds easy," put in Cal Klater, "but my texts ignore Π entirely. Can you recommend a good book?"

"Only if you read French, Cal. Legendre's *Fonctions Elliptiques*, written in 1825, is a masterpiece of logic and simplicity. You'll enjoy it."

[*The two acceptable answers came from Claude W. West and James R. Bole; others ranged from 16 ± to 150.7968 cu ft. Many Cal Klaters asked for a reference text or publication of the complete analysis; the former is furnished but the latter is too long for the column.*]

Ben Franklin's Birthday Celebrated

The 238th anniversary of the birth of Benjamin Franklin is as good a time as any to take stock of the unusual variety of his interests. Although he never professed to be an engineer, he was instrumental in the early development of community services that are today the province of the city planner. Street paving, lighting, and sanitary facilities came into being in the city of Philadelphia after a series of his untiring campaigns. The extract from his own account of 1756, which follows, indicates the foresight and energy that characterized his efforts for a much needed improvement.

"Our city, tho' laid out with a beautiful regularity, the streets large, strait, and crossing each other at right angles, had the disgrace of suffering those streets to remain long unpav'd, and in wet weather the wheels of heavy carriages plough'd them into a quagmire, so that it was difficult to cross them; and in dry weather the dust was offensive. I had liv'd near what was call'd the Jersey Market, and saw with pain the inhabitants wading in mud while purchasing their provisions.

"A strip of ground down the middle of that market was at length pav'd with brick so that, being once in the market, they had firm footing, but were often over shoes in dirt to get there. By talking and writing on the subject, I was at length instrumental in getting the street pav'd with stone between the market and the brick'd foot-pavement, that was on each side next the houses. This, for some time, gave an easy access to the market dry-shod; but, the rest of the street not being pav'd, whenever a carriage came out of the mud upon this pavement, it shook off and left its dirt upon it, and it was soon cover'd with mire, which was not remov'd, the city as yet having no scavengers.

"After some inquiry, I found a poor, industrious man, who was willing to undertake keeping the pavement clean, by sweeping it twice a week, carrying off the dirt from before all the neighbours' doors, for the sum of sixpence per month, to be paid by each house. I then wrote and printed a paper setting forth the advantages to the neighbourhood that might be obtain'd by this small expense; the greater ease in keeping our houses clean, so much dirt not being brought in by people's feet; the benefit to the shops by more custom, etc., etc., as buyers could more easily get at them; and by not having, in windy weather, the dust blown in upon their goods, etc., etc.

"I sent one of these papers to each house, and in a day or two went around to see who would subscribe an agreement to pay these sixpences; it was unanimously sign'd, and for a time well executed. All the inhabitants of the city were delighted with the cleanliness of the pavement that surrounded the market, it being a convenience to all, and this rais'd a general desire to have all the streets paved, and made the people more willing to submit to a tax for that purpose."

Franklin was always interested in city planning. His earliest concern in civic welfare was the danger of fires in the unprotected wooden town. He recalled with approval the volunteer fire companies in Boston, where he was born. To think with Franklin was to act, and accordingly he wrote a letter to himself and published it in his newspaper, the *Gazette*. This letter, which purported to be from an elderly citizen, discussed the "Protection of Towns from Fire," and stressed prevention of blazes by caution in carrying coals and by licensing chimney sweeps. It also pointed out that a neighboring town had had no extraordinary fire since its volunteer firemen's association was formed. With the help of the Junto, his club, Franklin soon had the matter going ahead. The Union Fire Company, made up of 30 volunteers, was formed by Franklin on December 7, 1736.

(The foregoing material was prepared by the National Franklin Committee, Franklin Institute, Philadelphia, Pa.)

Engineering Positions Available in Detroit

An announcement from the Detroit Civil Service Commission states that vacancies now exist in the architectural, civil, mechanical, electrical, and structural divisions of the City Engineer's staff. Numerous engineers and draftsmen are needed to assist in the preparation of plans, specifications, and drawings for urgently needed repairs and additions to existing utilities and services. Sewer, paving, salvage, construction, and other projects are contemplated.

In addition to generous pension and seniority provisions, high induction rates and overtime pay for over forty hours of work have been provided. Those interested should get in touch with the Detroit Civil Service Commission at the Water Board Building, 735 Randolph Street, Detroit, Mich.

Brief Notes

More than 70,000 names are included in the U.S. Directory of Registered Professional Engineers, verified and certified by the National Council of State Boards of Engineering Examiners. Following the main list there is a geographical breakdown. The Directory (676 pages) may be obtained through the Lewis Historical Publishing Company, 8th Avenue and 14th Street, New York, at $15 per copy, or there will be a discount to members who order through the Society.

* * * *

The new American Standard "Safety Code for Jacks" (ASA B30.1-1943) has just been printed and may be obtained from the American Society of Mechanical Engineers, 29 West 39th Street, New York, N.Y., at 30 cents a copy.

NEWS OF ENGINEERS

Personal Items About Society Members

ERNEST P. GOODRICH announces that he is terminating his personal service contract with the Navy Department for membership on the Price Adjustment Board, the Construction Division having been merged with the other activities, and will resume his general engineering practice at 175 Fifth Avenue, New York City.

FENNER H. WHITLEY, major Sanitary Corps of the U.S. Army, has been transferred from MacDill Field, Florida, to the Civil Affairs Section of Provost Marshall General at Yale University.

LOUIS C. SABIN, vice-president of the Lake Carriers' Association at Cleveland, Ohio, has been uniquely honored by recent Congressional action naming one of the locks of the St. Marys Falls Canal at Sault Ste. Marie, Michigan, for him. Mr. Sabin was the general superintendent of the canal and locks from 1906 to 1925, during which period the Sabin and Davis locks were built. The honor accorded Mr. Sabin is most unusual, as a ruling of the Engineer Department forbids the naming of a structure or facility after a living person.

JOHN A. SHAW, captain, Corps of Engineers, U.S. Army, has been transferred from Davis-Monthan Field at Tucson, Ariz., to the reception center at the Presidio of Monterey, California, where he will be post engineer.

WILLIAM D. ENNIS announces that, because of ill health, he will retire on March 1 as Humphreys Professor of Engineering Economics at Stevens Institute of Technology. From the date of his retirement he will have the designation of professor emeritus.

HERBERT D. MENDENHALL, lieutenant colonel, Corps of Engineers, U.S. Army, was recently awarded the Legion of Merit by the War Department "for exceptionally meritorious conduct in the performance of outstanding service as commander of the Internal Security Subdistrict comprising the southern part of the state of Georgia . . ." and for performing "the duties of engineering officer of the Fourth Service Command . . . ."

WALTER M. SMITH, consulting engineer for the Illinois State Division of Waterways at Chicago, has been elected a director of the Metropolitan Water Company of Chicago—an organization formed for the purpose of furnishing Lake Michigan water to about a hundred towns in the vicinity of Chicago.

V. J. BEDELL, colonel, Corps of Engineers, U.S. Army, was recently assigned to command the Mobile Port of Embarkation at Mobile, Ala.

JEREMIAH TEMPONE is now employed by the Reconstruction Finance Corporation at Cleveland, Ohio, as supervision engineer for the Defense Plant Corporation on the construction of facilities for the Republic Steel Corporation, lessee.

FREDERICK LIENHARD, associate of the late **LEON S. MOISSEIFF**, announces the opening of a consulting office at 99 Wall Street, New York. He will specialize in bridges, structures, and metals.

EDWARD S. COLE, president of the Pitometer Company, New York, has been elected to honorary membership in the American Water Works Association.

WILLIAM ROBERT EATON, associate hydraulic engineer for the U.S. Geological Survey, has been transferred from Chattanooga, Tenn., to Asheville, N.C., where he will be engineer in charge.

WILLIAM E. O'BRIEN has resigned as chairman of the Wisconsin State Highway Commission in order to become state director of the War Manpower Commission.

JOHN W. CRENSHAW, formerly associate sanitary engineer for the U.S. War Department at Wilmington, N.C., has been named senior engineer and superintendent of construction and maintenance at Camp Butner, N.C.

CLIFTON RICE has resigned as district engineer for the Texas State Highway Department at El Paso, because of poor health, and accepted a special assignment with the Department at Austin. Other changes include the promotion of V. G. **KOCH**, assistant district engineer at Lufkin, to the position of district engineer.

J. J. WOLTMANN, consulting engineer of Bloomington, Ill., was recently appointed acting chief of the state water survey at Urbana, Ill.

MARTIN W. KEHART has been promoted from the rank of lieutenant commander in the Civil Engineer Corps of the U.S. Naval Reserve to that of commander. He is public works officer at the Farragut (Idaho) Naval Training Station.

B. F. VANDERVOORT, colonel, Corps of Engineers, U.S. Army, recently retired from active duty after twenty-five years of service. He will be succeeded as chief of the price adjustment branch of the Ohio River Division of the Army Engineers by **MAJ. CASPAR W. HAUPT**, formerly chief of the price adjustment branch for the Great Lakes Division at Chicago.

RAYMOND W. MURPHY is now city engineer for Rye, N.Y.

GEORGE B. STURGEON has retired as maintenance engineer for the Mokelumne division of the East Bay Municipal District at Oakland, Calif., having reached the legal retirement age. Mr. Sturgeon had been in the service of the District since 1924.

LINDON J. MURPHY has been granted a leave of absence from his position as associate professor in the Engineering Extension Service of Iowa State College in order to accept a commission as major with the U.S. Public Health Service.

PHILIP A. UPP recently resigned as structural designer in the bridge office of the Wyoming State Highway Department in order to join the civil engineering staff at the University of Wyoming.

JOHN H. STRANGE is now a major in the Corps of Engineers, U.S. Army, the rank representing a promotion from that of captain. Prior to receiving his commission, Major Strange was city engineer for Waco, Tex.

DAMON RUNYAN, with Angus E. Slee, has formed the engineering firm of Runyan and Slee, with home offices in Longmont, Colo. They are engaged in utility appraisal for municipalities in the Rocky Mountain states and will engage in municipal engineering after the war. Until lately Mr. Runyan was architectural engineer for G. Meredith Musick, of Denver.

DECEASED

GEORGE HERBERT BILES (M. '18) for the past three years member of the Board of Revision of Taxes, Philadelphia, Pa., died on September 20, 1943. Mr. Biles, who was 63, began his career with the Philadelphia Department of Public Works. Beginning in 1905, he was for a number of years connected with the Pennsylvania State Highway Department at Harrisburg, finally becoming assistant state highway commissioner. Later he was assistant engineer for the Keystone State Corporation in Philadelphia.

EDWARD SYLVESTER BROWER (Assoc. M. '03) retired civil engineer of Ridgewood, N.J., died there suddenly on November 29, 1943. His age was 67. Early in his career Mr. Brower was in the Brooklyn (N.Y.) Borough President's Office. He then established a consulting practice in New York, which he maintained until his retirement a few years ago.

CHARLES BROE GALVIN (M. '35) retired engineer of New York, N.Y., died on November 18, 1943, at the age of 70. Mr. Galvin was in the employ of the City of New York from 1904 to 1910 and, again, from 1920 to his retirement in 1941. During the intervening period he patented an invention for surveying deep diamond drill holes and traveled in Europe, Asia, and Africa, studying important engineering works. His tenure with the City of New York included a six-year period as division engineer for the Department of Docks.

JOSEPH EMMETT HALL (M. '25) facilities engineer for the War Production Board at Indianapolis, Ind., died in October. Mr. Hall, who was 59, was for some years secretary and president of the Hall Construction Company in Indianapolis. From 1913 to 192 4he was connected with the Building Contractors Association of Indianapolis, and from the latter year to 1933 was with the General Contractors Association of Indianapolis (part of the time as president). He then resumed his connection with the

Hall Construction Company, and recently joined the staff of the War Production Board.

Dan Hulick (Assoc. M. '40) of Atlanta, Ga., died in March 1943, at the age of 61. At various times in his life (1912 to 1916 and, again, from 1919 to 1925) he was in private practice in Atlanta, Ga., and Greenville, S.C. From 1925 to 1935 he was city engineer of Greenville and, later was county engineer for Greenville County. From 1939 to 1942 he was sanitary engineer for the U.S.H.A.

Frederic Arnold Kummer (M. '06) of Baltimore, Md., died at his home in that city on November 22, 1943, at the age of 70. Beginning in 1896, Mr. Kummer was for some years chief engineer for the American Wood Preserving Company, and later became general manager of the Eastern Paving Block Company. In 1907 he gave up engineering work and turned to writing, and in the years since then had been successful both as a playwright and novelist.

David White McNaugher (M. '08) vice-president and treasurer of the Robert W. Hunt Company, Chicago consultant, died at his home in Pittsburgh, Pa., on November 24, 1943. Mr. McNaugher, who was 84, began his engineering career in 1885 as a member of the firm of G. W. G. Ferris and Company. Later the firm was known as the Halstead and McNaugher Company, and in 1900 it merged with the R. W. Hunt Company. Mr. McNaugher became vice-president and treasurer of the new concern, which maintained offices in the principal cities of the United States and Europe.

Samuel Wagner Marshall (M. '43) of the New York City firm of Parsons, Brinckerhoff, Hogan, and MacDonald, died suddenly on November 25, 1943. Mr. Marshall, who was 52, had been chief engineer for the Pennsylvania Department of Highways, for the Pennsylvania Turnpike Commission, and for the Caribbean Architect-Engineer. Earlier in his career (1921 to 1932) he maintained a consulting practice in Philadelphia. During the first World War he served overseas with the 28th Infantry Regiment, having the successive ranks of first lieutenant and captain.

Walter Raleigh Okeson (M. '11) secretary and treasurer of Lehigh University at Bethlehem, Pa., died recently. He was 67. Beginning in 1902, Mr. Okeson was for a number of years connected with the Phoenix Bridge Company—from 1902 to 1910 as assistant engineer and later as resident engineer for the organization in New York City. For the past twenty years he had been secretary and treasurer of Lehigh University, his alma mater.

Clifford Older (M. '15) consulting engineer of Wilmette, Ill., died in Rochester, Minn., on November 28, 1943, at the age of 67. Mr. Older was one of the organizers of the Illinois State Highway Department and, for many years, served as its chief engineer. Later he organized and became president of the Chicago firm of Consoer, Older, and Quinlan. He retired in 1932 to work on inventions connected with highway improvements—among them a steel road-expansion joint.

William Warr Cassidy Perkins (M. '12) chief engineer and secretary for the Eastern Paving Brick Association at Langhorne, Pa., died on October 27, 1943. His age was 75. Except for three years with the National Paving Brick Manufacturers' Association, Mr. Perkins had been with the Eastern Paving Brick Association since 1919. Earlier (1898 to 1906) he was construction engineer for Fairmont Park in Philadelphia; from 1906 to 1913, resident engineer for the New York State Highway Department at Buffalo; and from 1913 to 1919, chief engineer for the Dunn Wire-Cut Lug Brick Company, at Conneaut, Ohio.

John Wesley Ripley (M. '07) vice-president and treasurer of the Robbins-Ripley Company, of New York, N.Y., died at Great Neck, N.Y., on November 10, 1943. Mr. Ripley, who was 73, spent his early career as a draftsman with several engineering firms. He then (1897 to 1900) was assistant engineer for F. Stuart Williamson, and from 1900 to 1909 was chief engineer for John Monks and Sons. Since the latter year he had been vice-president and treasurer of the Robbins-Ripley Company. A specialist in structural steel design and waterfront development, Mr. Ripley helped prepare the master plant for New York City's East River piers.

Merton Rogers Sumner (M. '21) project manager for the John F. Casey Company and the McCrady Construction Company, of Pittsburgh, Pa., died on November 5, 1943. He was 54. From 1921 to 1923 Mr. Sumner was chief engineer for Arthur D. Little, Cambridge (Mass.) consultant, and from 1923 to 1931 was construction engineer for the Philadelphia Company properties in Pittsburgh. From the latter year to 1935 he was with the Mutual Life Insurance Company and, at one time, he was lecturer in advanced economics courses at the University of Pittsburgh.

Thomas Thomson Towles (M. '22) died at his home in Charlottesville, Va., on September 27, 1943, at the age of 57. From 1912 to 1914 Mr. Towles was with the Isthmian Canal Commission on the design and construction of the Miraflores Locks; from 1915 to 1917, with the Santa Fe Railway at Galveston, Tex.; from 1918 to 1921, with the Dupont Engineering Company at Wilmington, Del.; and from 1921 to 1926 with the Richmond (Va.) Department of Public Works. In the latter year Mr. Towles became connected with the Stone and Webster Engineering Corporation in New York, where he remained until May 1942 when ill health forced his retirement.

John Lane Van Ornum (M. '99) professor emeritus of civil engineering at Washington University, St. Louis, died at his home at Clayton, Mo., on November 6, 1943. He was 79. Professor Van Ornum was appointed head of the department of civil engineering at Washington University in 1897 and served continuously in that capacity until his retirement in June 1933. Earlier in his career he had been U.S. assistant engineer on harbor works in Georgia and Florida and river surveys in Georgia and Tennessee, and from 1891 to 1894 he was chief topographer for the Mexican Boundary Survey.

Changes in Membership Grades

Additions, Transfers, Reinstatements, and Resignations

From November 10 to December 9, 1943, Inclusive

ADDITIONS TO MEMBERSHIP

Ackerman, Raymond John (Jun. '43), Eng. Draftsman, Douglas Aircraft Co., Inc., El Segundo (Res., 833 Ocean Ave., Santa Monica), Calif.

Adler, Milton Robert (Jun. '43), Private, U.S. Army; 3668 Fowler Ave., Omaha, Nebr.

Akkerman, Richard Pete (Assoc. M. '43), Plant Design Engr., Houston Ship Building Corp., Irish Bend Island, Houston, Tex.

Anderson, James Aylor, Jr. (Jun. '43), 2d Lt., Field Artillery, U.S. Army; "Sunnyside," Lexington, Va.

Anderson, Melvin Hylden (Jun. '43), 2d Lt., Air Corps, U.S. Army; 2907 South Zarzamora St., San Antonio, Tex.

Anderson, William Ernest (Assoc. M. '43), Dist. Engr., SCS, Box 99, Montrose, Colo.

Angele, Gustave John (Assoc. M. '43), Asst. Mech. Engr., TVA, 207 Union Bldg., Knoxville, Tenn.

Armstrong, William Gilbert (Assoc. M. '43), Vice-Pres., Chg. of Dredging, The Arundel Corp., Pier 2, Pratt St., Baltimore, Md.

Astrue, Charles John (Jun. '43), Ensign, U.S.N.; 143 East 39th St., New York 16, N.Y.

Banner, Joseph Thomas (Assoc. M. '43), Project Administrator, R. J. Tipton, 1231 First National Bank Bldg. (Res., 3809 Winona Court), Denver, Colo.

Bauer, Herbert Gottlieb (Jun. '43), 510 Medary Ave., Brookings, S.Dak.

Bechly, Dan Smiley (Jun. '43), Eng. Draftsman, Douglas Aircraft Co., Inc., El Segundo (Res., 833 Ocean Ave., Santa Monica), Calif.

Benson, Robert Elmo (Assoc. M. '43), Associate Civ. Engr., U.S. Engr. Office, 751 South Figueroa St., Los Angeles (Res., 1153 South 2d St., Alhambra), Calif.

Bolton, Donald Frank (Jun. '43), Adv. Junior Engr., Seattle-Tacoma Shipbuilding Corp. (Res., Salishan, 264 Auburn Ave.), Tacoma 5 Wash.

Bostow, Alfred Arthur (Jun. '43), Designer, Leeds, Hill, Barnard & Jewett, Box 791 (Res., 2144 West Jefferson St.), Phoenix, Ariz.

Bowles, William Roberts (Jun. '43), Lt., Corps of Engrs., U.S. Army; 1223 South Columbia, Tulsa, Okla.

Brenner, Nathan (Jun. '43), Asst. Engr. (Civ.), Corps of Engrs., War Dept. (Res., 185 Van Buren St.), Brooklyn 21, N.Y.

Brevard, Henry Clyde, Jr. (Jun. '43), Private, Air Corps, U.S. Army; Second Ave., South, Armory, Miss.

Briley, Harold Dale (Assoc. M. '43), Designing and Office Engr., Russell & Axon, Inc., 3903 St. Johns Ave., Jacksonville 5, Fla.

Broom, Henry Charles (Jun. '43), Junior Hydr. Engr., U.S. Geological Survey, 207 Federal Bldg., Tacoma, Wash.

Bunger, Howard Phelps, Jr, (Jun. '43), Ensign, CEC-V (S), U.S.N.R., Barracks E-2-68, Camp Peary, Va.

Burns, Robert Emmett, Jr. (Jun. '43), Stress Analyst, Consolidated Vultee Aircraft Corp. (Res., 1101 North West 18th), Forth Worth, Tex.

Carcaterra, Thomas (Jun. '43), Eng. Draftsman, Consolidated Vultee Aircraft Corp. (Res., 729 Seventh Ave.), San Diego, Calif.

Carpenter, Whitman Stratton (Jun. '43), 2d Lt., U.S.M.C.R.; 218 Wisner Ave., Middletown, N.Y.

Cate, Sydney Luther, Jr. (Jun. '43), Corporal, U.S. Army; 544 Douglas St., Salt Lake City, Utah.

Clark, Warren Allen (Jun. '43), Junior Engr. (Cartographic), P-1, Navy Hydrographic Offices, Suitland, Md. (Res., 4001 Alabama Ave., S.E., Washington 20, D.C.)

Clayton, Nelson Widdison (Jun. '43), Ensign, U.S.N.R., Norfolk Navy Yard, Portsmouth, Va.

Colwell, Walton Byron, Jr. (Jun. '43), Private, Air Corps, U.S. Army, Squadron F, Section 45, Seymour Johnson Field, N.C.

Cook, Malcolm Cade (Jun. '43), Lt., Field Artillery, U.S. Army; Union Springs, Ala.

Coulson, Paul Russell (Jun. '43), Engr., Chance Vought Aircraft, Stratford (Res., Y.M.C.A., Bridgeport 3), Conn.

Crout, Jesse Webb (Assoc. M. '43), Engr., Brown Shipbuilding Co. (Res., 1405 Webster St., Apt. 6), Houston, Tex.

Crumley, Clarence Cottrell (Jun. '43), Eng. Draftsman, Douglas Aircraft Co., Inc. (Res., 2433 Marine St.), Santa Monica, Calif.

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TOTAL MEMBERSHIP AS OF DECEMBER 9, 1943

Members	6,017
Associate Members	7,351
Corporate Members	13,368
Honorary Members	36
Juniors	5,900
Affiliates	74
Fellows	1
Total	19,379
(Total Dec. 9, 1942	18,288)